

FINAL REPORT

# US 60 | US 70 | US 191 Corridor Profile Study

*Florence Junction (SR 79 Junction) to Douglas*

PREPARED FOR **ADOT** MARCH 2017

ADOT WORK TASK NO.  
MPD 029-16

ADOT CONTRACT NO.  
DT11-013154

Prepared by



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ARIZONA DEPARTMENT OF TRANSPORTATION



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# ACRONYMS & ABBREVIATIONS

AADT	Average Annual Daily Traffic	NB	Northbound
ABISS	Arizona Bridge Information and Storage System	NPV	Net Present Value
ADOT	Arizona Department of Transportation	OP	Overpass
AGFD	Arizona Game and Fish Department	P2P	Planning to Programming
ASLD	Arizona State Land Department	PA	Project Assessment
AZTDM	Arizona Travel Demand Model	PARA	Planning Assistance for Rural Areas
BLM	Bureau of Land Management	PDI	Pavement Distress Index
BQAZ	Building a Quality Arizona	PES	Performance Effectiveness Score
CAG	Central Arizona Governments	PSR	Pavement Serviceability Rating
CCTV	Closed Circuit Television	PTI	Planning Time Index
CPS	Corridor Profile Study	RTP	Regional Transportation Plan
CR	Cracking Rating	RWIS	Road Weather Information System
DCR	Design Concept Report	SATS	Small Area Transportation Study
DMS	Dynamic Message Sign	SB	Southbound
EB	Eastbound	SEAGO	South Eastern Arizona Governments Organization
FHWA	Federal Highway Administration	SHSP	Strategic Highway Safety Plan
FY	Fiscal Year	SOV	Single Occupancy Vehicle
HCRS	Highway Condition Reporting System	SR	State Route
HERE	Real time traffic conditions database produced by American Digital Cartography Inc.	SVMPO	Sierra Vista Metropolitan Planning Organization
HPMS	Highway Performance Monitoring System	SWAP	State Wildlife Action Plan
I	Interstate	TAC	Technical Advisory Committee
IRI	International Roughness Index	TI	Traffic Interchange
ITS	Intelligent Transportation System	TIP	Transportation Improvement Plan
LCCA	Life-Cycle Cost Analysis	TPTI	Truck Planning Time Index
LOS	Level of Service	TTI	Travel Time Index
LPOE	Land Point of Entry	TTTI	Truck Travel Time Index
LRTP	Long Range Transportation Plan	UP	Underpass
MAG	Maricopa Association of Governments	UPRR	Union Pacific Railroad
MAP-21	Moving Ahead for Progress in the 21st Century	USDOT	United States Department of Transportation
MP	Milepost	V/C	Volume to Capacity Ratio
MPD	Multimodal Planning Division	VMT	Vehicle-Miles Travelled
		VPD	Vehicles Per Day
		WB	Westbound
		WIM	Weigh-in-Motion

# EXECUTIVE SUMMARY

## INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of US Route 60|US 70 from State Route (SR) 79 to the US 191 Junction and of US 191 from US 70 to the SR 80 Junction (US 60|US 70|US 191). This study examines key performance measures relative to the US 60|US 70|US 191 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT’s Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven corridor profile studies within three separate groupings. The US 60|US 70|US 191 corridor, depicted in **Figure ES-1**, is one of the strategic statewide corridors identified and the subject of this CPS.

### Corridor Study Purpose, Goals and Objectives

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

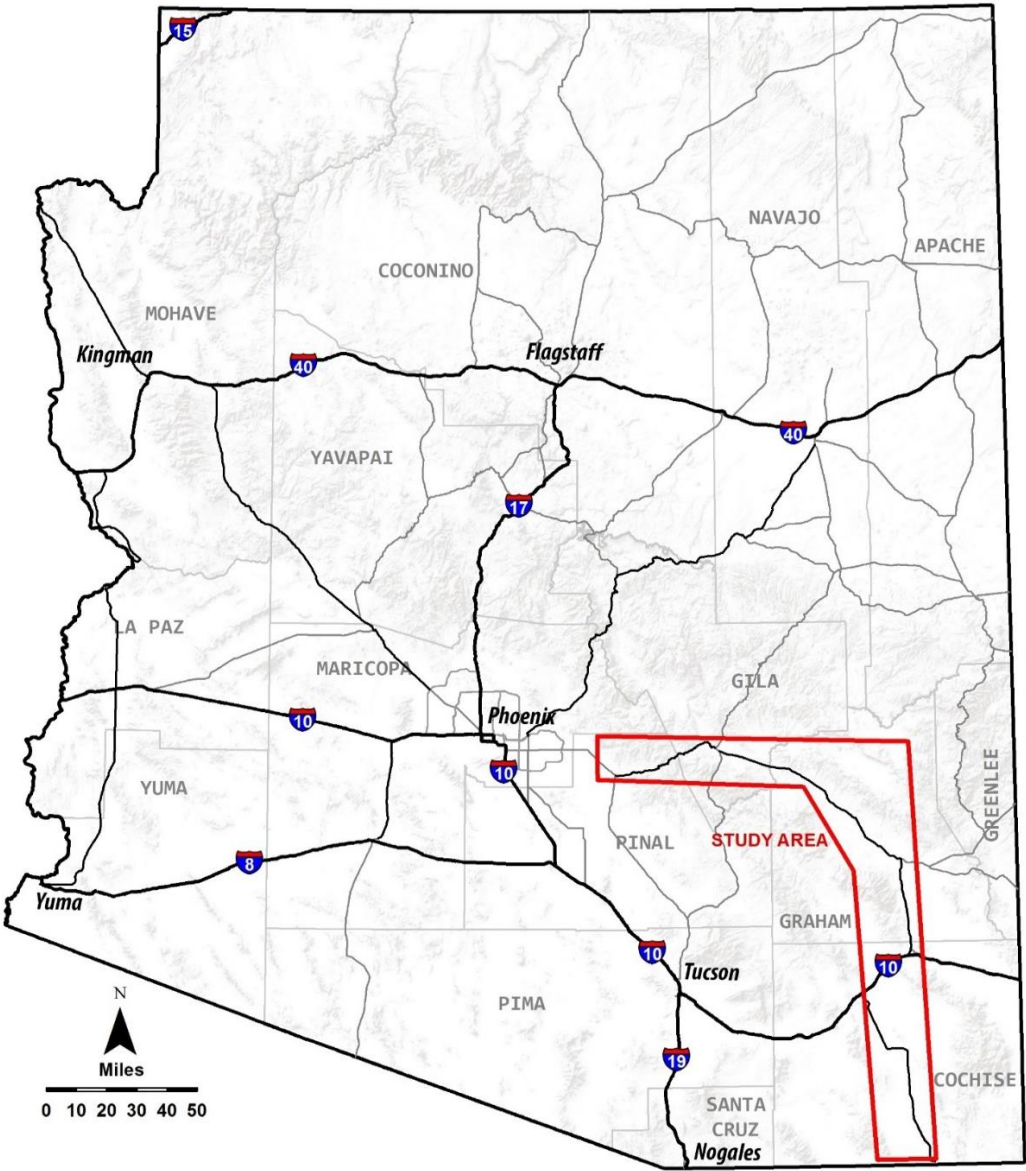
- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation

The objective of the US 60|US 70|US 191 CPS is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The US 60|US 70|US 191 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance.

The following goals are identified as the outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

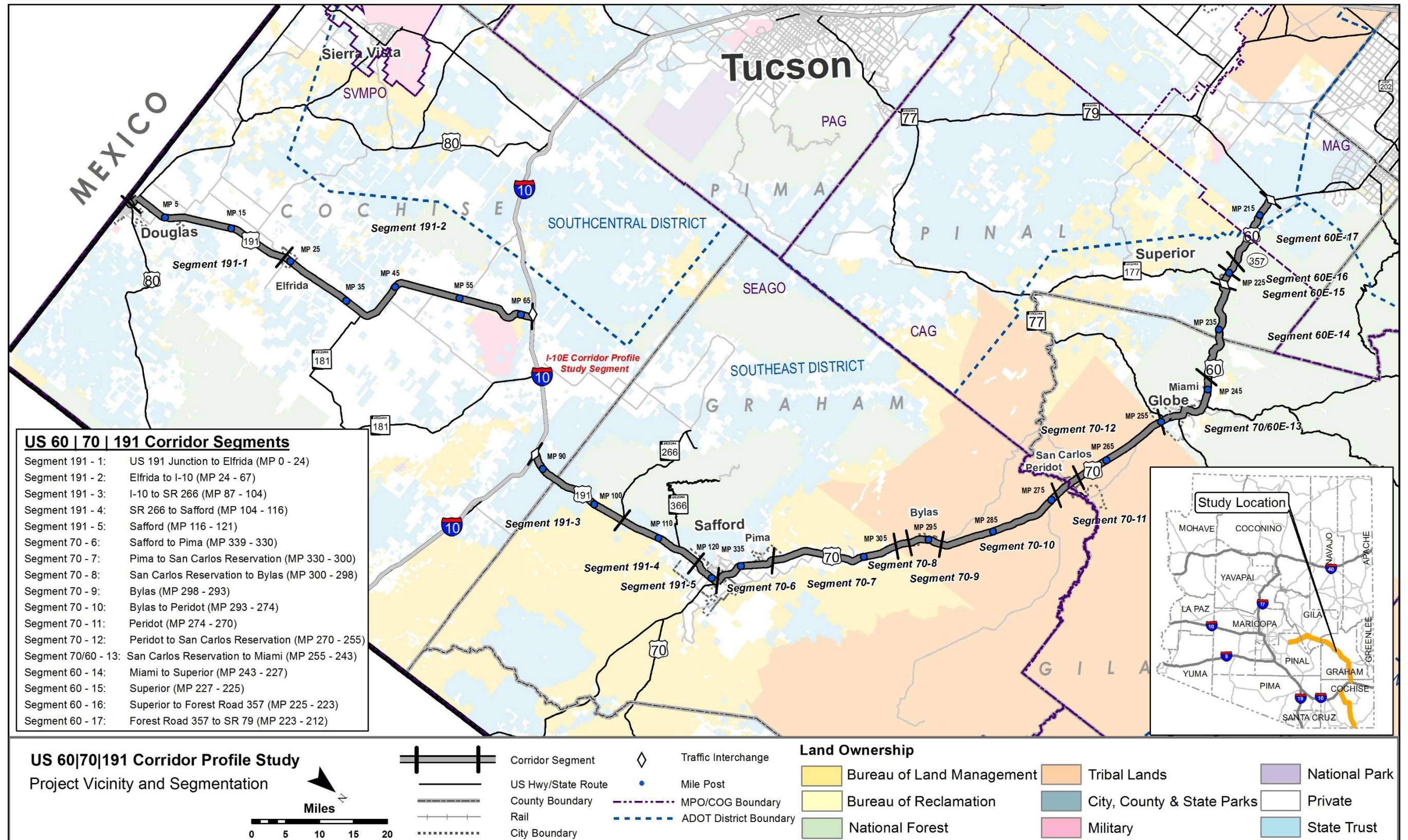
Figure ES-1: Corridor Study Area



### Study Location and Corridor Segments

The US 60|US 70|US 191 CPS divides the corridor into seventeen planning segments to facilitate analysis and evaluation. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are shown in **Figure ES-2**.

Figure ES-2: Corridor Location and Segments



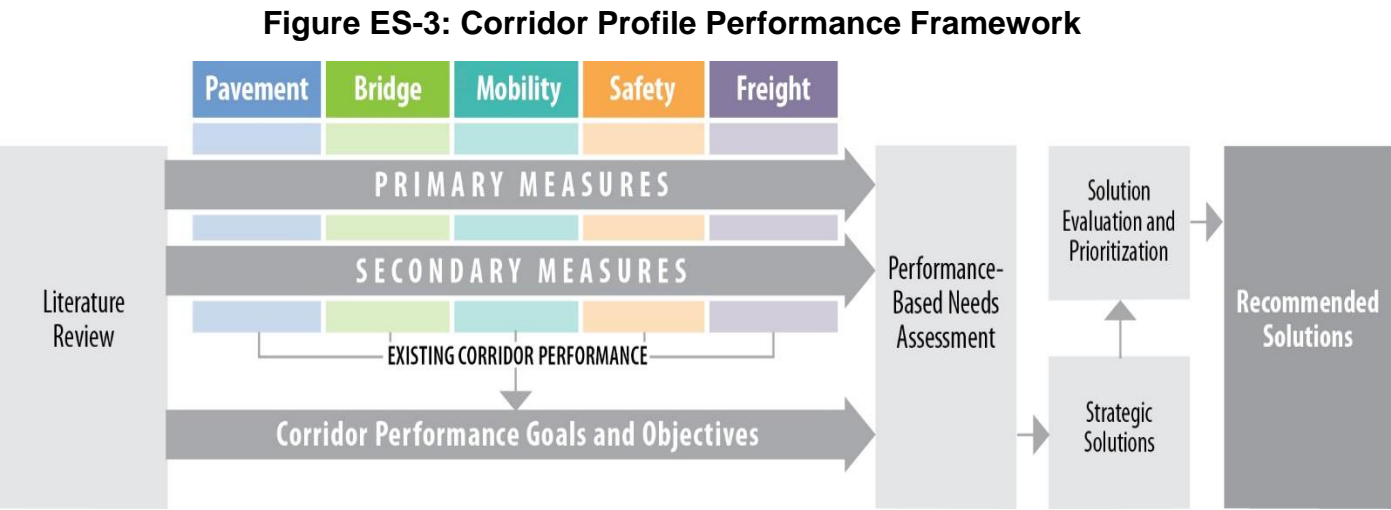
## CORRIDOR PERFORMANCE

A series of performance measures are used to assess the US 60|US 70|US 191 corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

### Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

**Figure ES-3** illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance.



The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance. **Table ES-1** provides the complete list of primary and secondary performance measures for each of the five performance areas.

**Table ES-1: Corridor Performance Measures**

Performance Area	Primary Measure	Secondary Measures
Pavement	<b>Pavement Index</b> Based on a combination of International Roughness Index and cracking	<ul style="list-style-type: none"> <li>• Directional Pavement Serviceability</li> <li>• Pavement Failure</li> <li>• Pavement Hot Spots</li> </ul>
Bridge	<b>Bridge Index</b> Based on lowest of deck, substructure, superstructure and structural evaluation rating	<ul style="list-style-type: none"> <li>• Bridge Sufficiency</li> <li>• Functionally Obsolete Bridges</li> <li>• Bridge Rating</li> <li>• Bridge Hot Spots</li> </ul>
Mobility	<b>Mobility Index</b> Based on combination of existing and future daily volume-to-capacity ratios	<ul style="list-style-type: none"> <li>• Future Congestion</li> <li>• Peak Congestion</li> <li>• Travel Time Reliability</li> <li>• Multimodal Opportunities</li> </ul>
Safety	<b>Safety Index</b> Based on frequency of fatal and incapacitating injury crashes	<ul style="list-style-type: none"> <li>• Directional Safety Index</li> <li>• Strategic Highway Safety Plan Emphasis Areas</li> <li>• Crash Unit Types</li> <li>• Safety Hot Spots</li> </ul>
Freight	<b>Freight Index</b> Based on bi-directional truck planning time index	<ul style="list-style-type: none"> <li>• Recurring Delay</li> <li>• Non-Recurring Delay</li> <li>• Closure Duration</li> <li>• Bridge Vertical Clearance</li> <li>• Bridge Vertical Clearance Hot Spots</li> </ul>

Each of the primary and secondary performance measures identified in the table above is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance	Rating is above the identified desirable/average range
Fair/Average Performance	Rating is within the identified desirable/average range
Poor/Below Average Performance	Rating is below the identified desirable/average range

The terms “good”, “fair”, and “poor” apply to the Pavement, Bridge, Mobility, and Freight performance measures, which have defined thresholds. The terms “above average”, “average”, and “below average” apply to the Safety performance measures, which have thresholds referenced to statewide averages.

**Corridor Performance Summary**

**Table ES-2** shows a summary of corridor performance for all primary measures and secondary measure indicators for the US 60|US 70|US 191 corridor. A weighted corridor average rating (based on the length of the segment) was calculated for each primary and secondary measure as shown in **Table ES-2**.

The five areas evaluated are split between “good” (41%), “fair” (29%), and “poor” (31%) ratings. The poorest performing segment is 60-14 which rates as “poor” in bridge, safety, & freight, and “fair” in pavement & mobility. The highest performing segments, 191-4, 70-7, 70-8, and 60-17, do not have “poor” performance areas, and 70-8 in the Bylas on the San Carlos Apache Reservation rated the best performance through this segment, which is only two miles in length.

- Pavement Performance:** All of the 214 miles on the US 60|US 70|US 191 corridor rate as “good” or “fair” for the overall Pavement Index. Due to the significant areas of roughness and pavement cracking, 3 of the 9 segments rate poorly for percentage of area in failure.
- Bridge Performance:** A total of 48 bridges were included in the evaluation. Four bridges on US 60 are considered structurally deficient, including Queen Creek Bridge (MP 227.71, No. 406), Waterfall Canyon Bridge (MP 229.50, No. 328), Pinto Creek Bridge (MP 238.25, No. 351), and Pinal Creek Bridge (MP 249.64, No. 266).
- Mobility Performance:** US 60|US 70|US 191 corridor is considered to have two operating environments for evaluating Mobility. These include Urban/Fringe Urban Highway and Rural Highway. Both the current and future capacity is considered “good” with the exception of 60-14 and 60-15, the area between Miami and Superior, which has mountainous terrain.
- Safety Performance:** Safety performance utilizes the three operating environments for analysis that compare fatal and incapacitating injury crashes to other similar routes statewide. The US 60|US 70|US 191 corridor is mixed between “good” and “poor” ratings. Higher than average fatal crashes occurred on Segments 70-9 and 70-12 through 70-14, with an additional five segments having insufficient crash data.
- Freight Performance:** The performance of freight mobility is overall “poor” within the US 60|US 70|US 191 corridor. This is primarily due to the high PTI. Traffic counters do not exist in 9 of the 17 segments, which does not allow for the performance to be measured for TTI and PTI for much of the corridor.

Table ES-2: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area												
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Hour V/C		Closure Extent (instances/milepost/year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips	
			NB/WB	SB/EB								NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB			
191-12*	24	3.64	3.37	3.37	0%	6.00	89.00	0%	6	0.15	0.17	0.12	0.12	0.03	0.01	1.51	1.30	4.79	7.47	66%	12.5%	
191-22*	43	3.06	3.31	3.31	30%	5.37	76.93	0%	5	0.09	0.10	0.07	0.07	0.02	0.00	1.16	1.16	9.83	6.09	100%	16.0%	
191-32^	17	3.93	3.94	4.02	3%	6.02	93.91	0%	5	0.04	0.04	0.03	0.03	0.01	0.00	1.39	1.20	9.51	11.62	49%	9.8%	
191-42^	12	3.28	3.28	3.28	17%	6.00	69.50	0%	6	0.18	0.20	0.14	0.14	0.03	0.03	N/A	N/A	N/A	N/A	96%	9.3%	
191-51*	5	3.28	3.28	3.28	20%	No Bridges				0.33	0.39	0.27	0.28	0.12	0.08	N/A	N/A	N/A	N/A	27%	22.5%	
70-61*	9	3.70	3.44	3.44	10%	6.00	69.10	0%	6	0.53	0.69	0.32	0.32	0.02	0.06	N/A	N/A	N/A	N/A	46%	19.0%	
70-72^	19	3.43	3.35	3.35	5%	5.77	71.59	0%	5	0.18	0.21	0.13	0.13	0.02	0.00	N/A	N/A	N/A	N/A	73%	16.8%	
70-82^	2	3.87	3.78	3.78	0%	6.00	74.00	0%	6	0.12	0.15	0.08	0.08	0.00	0.10	N/A	N/A	N/A	N/A	0%	13.8%	
70-92^	5	3.81	3.80	3.80	0%	No Bridges				0.25	0.29	0.16	0.17	0.00	0.04	N/A	N/A	N/A	N/A	26%	12.2%	
70-102^	19	3.87	3.55	3.55	5%	7.00	80.00	0%	7	0.17	0.19	0.11	0.11	0.09	0.04	N/A	N/A	N/A	N/A	4%	8.9%	
70-112^	4	3.88	3.55	3.55	0%	7.54	82.03	0%	5	0.21	0.26	0.12	0.12	0.10	0.00	N/A	N/A	N/A	N/A	4%	13.7%	
70-122^	15	3.97	3.83	3.83	0%	6.00	63.20	0%	6	0.19	0.23	0.13	0.13	0.04	0.31	N/A	1.10	N/A	1.40	23%	12.1%	
70 60-131*	12	3.65	3.43	3.34	19%	5.17	78.89	49%	4	0.40	0.46	0.29	0.30	0.00	0.12	1.15	1.31	2.72	3.36	54%	17.0%	
60-142^	16	3.43	3.24	3.24	31%	4.56	18.49	0%	4	1.73	2.11	1.22	1.09	0.33	1.57	1.07	1.19	1.47	2.06	49%	15.0%	
60-152^	2	3.21	2.92	2.92	50%	6.00	83.70	57%	6	2.76	3.83	1.28	1.30	0.36	1.17	1.08	1.17	1.67	2.30	95%	13.0%	
60-162^	2	3.32	3.38	3.38	0%	5.00	86.66	0%	5	0.54	0.71	0.28	0.28	0.50	0.00	1.09	1.00	1.91	1.04	87%	9.0%	
60-172^	11	4.30	4.14	4.02	0%	6.42	91.11	0%	5	0.20	0.26	0.11	0.10	0.09	0.05	1.01	1.01	1.16	1.24	96%	10.0%	
Weighted Corridor Average		3.57	3.49	3.49	13%	5.56	72.20	3%	5	0.32	0.39	0.22	0.21	0.06	0.17					61%	14%	
SCALE																						
Performance Level		Non-Interstate				All				Urban <sup>1</sup> Rural <sup>2</sup>				All		Uninterrupted <sup>^</sup> Interrupted <sup>*</sup>					All	
Good / Above Average		> 3.50				< 5%	> 6.5	> 80	< 12%	> 6	≤ 0.71 (Urban) ≤ 0.56 (Rural)				< 0.22		≤ 1.15 ≤ 1.3		≤ 1.3 ≤ 3.0		> 90%	> 17%
Fair / Average		2.9-3.5				5%-20%	5.0 - 6.5	50 - 80	12%-40%	5 - 6	0.71 - 0.89 (Urban) 0.56 - 0.76 (Rural)				0.22 - 0.62		1.15 - 1.33 ≤ 1.3		1.3 - 1.5 3.0 - 6.0		90% - 60%	17% - 11%
Poor / Average		< 2.90				> 20%	< 5.0	< 50	> 40%	< 5	> 0.89 (Urban) > 0.76 (Rural)				≥ 0.62		≥ 1.33 ≥ 2.0		≥ 1.5 ≥ 6.0		< 60%	< 11%

<sup>1</sup> Urban or Fringe Urban Operating Environment

<sup>2</sup> Rural Operating Environment

<sup>^</sup> Uninterrupted

<sup>\*</sup> Interrupted

Table ES-2: Corridor Performance Summary by Segment and Performance Measure (continued)

Segment #	Segment Length (miles)	Safety Performance Area							Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Segment Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Freight Index	Directional TTTI (trucks only)		Directional TPTI (trucks only)		Closure Duration (mins/milepost/closed/year/ mile)		Bridge Vertical Clearance (feet)
			NB/WB	SB/EB						NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	
191-1a*	24	0.44	0.10	0.78	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.10	1.94	1.60	9.11	11.62	6.78	0.61	No UP
191-2a*	43	0.28	0.53	0.03	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.09	1.00	1.54	2.68	19.67	2.41	0.70	22.04
191-3b^	17	1.00	0.00	2.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.08	1.34	1.82	8.92	17.43	2.94	0.00	No UP
191-4a^	12	0.03	0.07	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	3.37	4.02	No UP
191-5c*	5	1.30	1.34	1.25	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	26.32	40.04	No UP
70-6c*	9	0.93	1.68	0.18	73%	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	3.96	16.64	No UP
70-7a^	19	0.10	0.20	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	2.42	0.00	17.03
70-8a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	0.00	22.10	No UP
70-9a^	5	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	0.00	15.52	No UP
70-10a^	19	1.88	1.50	2.25	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	21.73	25.56	No UP
70-11a^	4	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	N/A	N/A	N/A	27.45	0.00	No UP
70-12a^	15	1.67	1.67	1.67	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	N/A	1.14	N/A	2.01	7.71	127.15	No UP
70 60-13c*	12	2.09	1.64	2.55	57%	Insufficient Data	Insufficient Data	Insufficient Data	0.19	1.24	1.46	4.29	6.19	0.00	19.07	15.84
60-14a^	16	3.23	2.23	4.23	55%	Insufficient Data	Insufficient Data	Insufficient Data	0.43	1.18	1.60	2.34	2.36	68.54	378.72	13.03
60-15a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.33	1.13	1.25	1.87	4.23	107.46	249.09	16.79
60-16a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.49	1.14	1.00	2.98	1.12	108.80	0.00	No UP
60-17b^	11	0.81	1.28	0.33	42%	Insufficient Data	Insufficient Data	Insufficient Data	0.72	1.07	1.14	1.23	1.54	13.65	19.62	No UP
Weighted Corridor Averages		1.01	0.87	1.15					0.52					13.31	45.89	
SCALE																
Performance Level		2 or 3 Lane Undivided Highway 2, 3 or 4 Lane Divided Highway 4 or 5 Lane Undivided Highway							Uninterrupted Interrupted				All			
Good/Above Average		a	≤ 0.94		< 51.2%	< 5.2%	< 18.5%	< 2.2%	> 0.77	<1.15	< 1.3	< 44.18		> 16.5		
		b	≤ 0.77		< 44.4%	< 3.5%	< 16.3%	< 2.4%	> 0.33	< 1.30	≤ 3.0					
		c	≤ 0.80		< 42.4%	< 6.1%	< 6.4%	< 4.7%								
Fair/Average		a	0.94-1.06		51.2% - 57.5%	5.2% - 7.1%	18.5% - 26.5%	2.2%-4.2%	0.67-0.77	1.15-1.33	1.3-1.5	44.18-124.86		16.0-16.5		
		b	0.77-1.23		44.4% - 54.4%	3.5% - 7.3%	16.3% - 26.3%	2.4%-4.5%	0.17-0.33	1.30-2.0	3.0-6.0					
		c	0.80-1.20		42.4% - 51.1%	6.1% - 9.6%	6.4% - 9.4%	4.7%-7.9%								
Poor/Below Average		a	≥ 1.06		> 57.5%	> 7.1%	> 26.5%	> 4.2%	< 0.67	>1.33	> 1.5	> 124.86		<16.0		
		b	≥ 1.23		> 54.4%	>7.3%	> 26.3%	> 4.5%	<0.17	> 2.0	> 6.0					
		c	≥ 1.20		> 51.1%	> 9.6%	> 9.4%	> 7.9%								

<sup>a</sup> 2 or 3 Lane Undivided

<sup>b</sup> 2,3 or 4 Lane Divided

<sup>c</sup> 4 or 5 Lane Undivided

<sup>^</sup> Uninterrupted

<sup>\*</sup> Interrupted

Note: “Insufficient Data” indicates there was not enough data available to generate reliable performance ratings  
“No UP” indicates no underpasses are present in the segment

## NEEDS ASSESSMENT

### Corridor Description

The US 60|US 70|US 191 corridor links the Mexico border at the City of Douglas and the Phoenix metropolitan area to agricultural, mining and recreational activity in southeastern Arizona. In general, all three highways are two-lane facilities designed for relatively modest traffic volumes in a rural setting. At the same time, the corridor offers some unique benefits within the Arizona circulation system that could be leveraged for increased usage as the need arises.

US 191 provides a link between Mexico and Interstate 10 (I-10), the primary east-west interstate corridor along the southern states. As a result, US 191 serves as a major freight corridor for goods moving between Mexico and the United States. Similarly, the combination of US 191 and US 70 between I-10 and Globe offers a critical connection to mining and agricultural interests located in the greater Safford and Globe areas of Graham and Pinal Counties. US 60 between Globe and SR 79 links activities within the corridor to the major population and commerce center of the Phoenix metropolitan area.

### Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to US 60|US 70|US 191 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three “emphasis areas” were identified for the US 60|US 70|US 191 corridor: Mobility, Safety and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and the performance objectives.

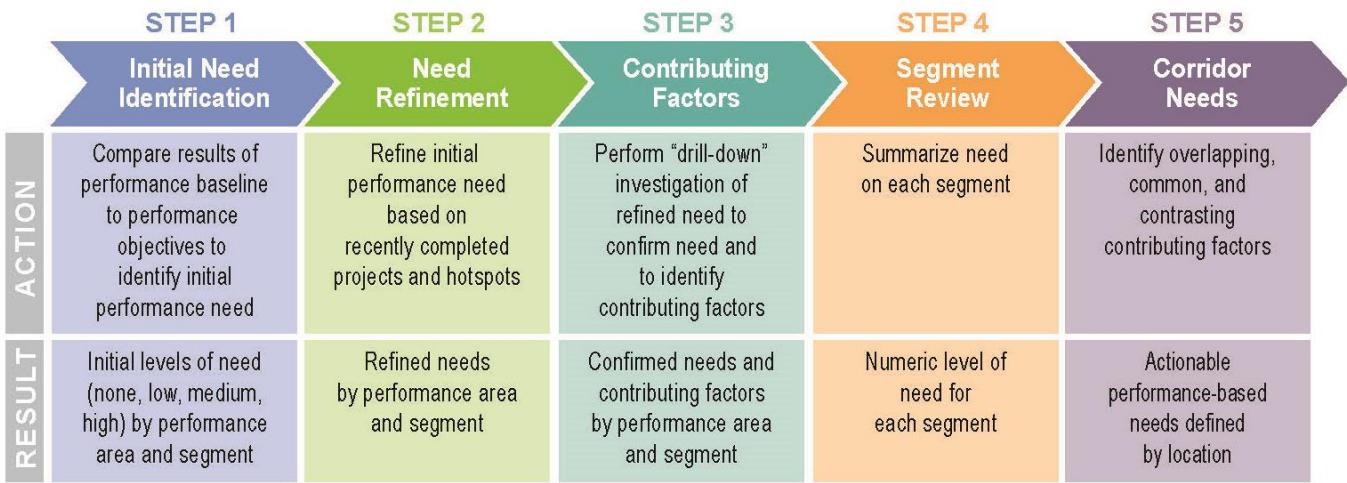
### Needs Assessment Process

The performance-based needs assessment evaluates the difference between the baseline performance and the performance objectives for each of the five performance areas used to characterize the health of the corridor: Pavement, Bridge, Mobility, Safety, and Freight. The performance-based needs assessment process is illustrated in **Figure ES-4**.

The needs assessment compares baseline corridor performance with performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown in **Figure ES-5**.

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. A detailed review of available data helps identify contributing factors to the need and if there is a high level of historical investment.

**Figure ES-4: Needs Assessment Process**



**Figure ES-5: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)**

Performance Thresholds	Performance Level	Initial Level of Need	Description
6.5	Good	None*	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
5.0	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
	Fair		
	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

*\*A segment need rating of ‘None’ does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

## Summary of Needs

**Table ES-3** provides a summary of needs for each segment across all performance areas, and the average needs for each segment. A weighting factor of 1.5 is applied to the average need scores of the performance areas identified as emphasis areas (mobility, safety, and freight for the US 60|US 70|US 191 corridor). There are 10 segments with a high average need, seven segments with a medium average need, and 31 segments with a low average need. More information on the identified final needs in each performance area is provided below.

### Pavement Needs

- Ten segments (60-15, 60-14, 70|60-13, 70-10, 70-7, 70-6, 191-5, 191-4, 191-3, and 191-2) contain pavement hot spots. Most of the hot spots in Segment 191-2 had recent paving projects that addressed the need. Construction for passing lanes in Segment 60-14 will address some of the current pavement issues. The reconstruction project currently underway for Segment 60-15 will address the pavement issues.
- Segments 70|60-13, 70-10, 70-7, 70-6, 191-3, and 191-2 have final needs of low and Segments 191-4 and 191-5 have final needs of Medium. All other segments on the corridor have a final need of None.

### Bridge Needs

- Bridge needs were identified on three segments of the corridor, 43 miles (20%) with a “Medium” level of bridge need and 28 miles (13%) with a “High” level of bridge need.
- Eight bridges showed potential repetitive investment issues and may be candidates for life-cycle cost analysis to evaluate alternative solutions.
- Three bridges have bridge ratings of 4: Pinal Creek Bridge (No. 266), Waterfall Canyon Bridge (No. 328), and Queen Creek Bridge (No. 406).
- One bridge had a bridge rating of 5: Pinal Creek Bridge (No. 36).
- Nine bridges were defined as hot spots since they had multiple bridge ratings of 5 or less.
- Of the nine hot spot bridges, five also showed repetitive investment issues. These included the Pinal Creek Bridge (No. 36), Pinal Creek Bridge (No. 266), Pinto Creek Bridge (No. 351), Waterfall Canyon Bridge (No. 328), and Queen Creek Bridge (No. 406).

### Mobility Needs

- Mobility Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A low level of mobility need was identified on 168 miles (79%) of the US 60| US 70| US 191 corridor and a Medium level of mobility need was identified on 33 miles (15%) of the corridor.
- Contributing factors include to reduced mobility performance includes:
  - Closures of the roadway due to flooding (US 191 at MP 53 and MP 66),
  - A concentration of short term closures due to incidents/accidents throughout corridor,
  - A significant number of extended duration closures on US 60 from MP 225 – 228,

- Mountainous grades with a lack of climbing lanes on US 60 from MP 227 – 243,
- Limited passing, acceleration and deceleration on rolling terrain on US 70 from MP 255 – 330,
- Rock-fall on US 60 caused repeated incidents of delay and closures between MP 228 – 248,
- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions,
- Limited bicycle accommodation on much of the corridor, on US 191 from MP 87 – 104 and MP 116 – 121, and US 60/70 from MP 298 – 243.

### Safety Needs

- Safety Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A high level of safety need was identified for 67 miles (31%) of the corridor and low level of safety need identified for 37 miles (17%) of the corridor.
- Contributing factors to the safety need include:
  - Fatalities on SB US 191 in the vicinity of MP 91 – 93, which were single vehicle roll over crashes involving high speed.
  - On both US 191 and US 70 in the Safford area, factors included lack of pedestrian lighting and pedestrian facilities, traffic control device reflectivity, intersection geometry, and high traffic volumes.
  - US 70 from Bylas to Peridot, MP 293 – 274, long stretch of rolling terrain with limited passing lanes and rest areas, with safety factors including shoulder conditions and width, traffic control device reflectivity, clear zone slope and obstructions, and intersection geometry.
  - US 60|US 70 from Peridot to Superior, lack of passing and climbing lanes, deceleration lanes, pedestrian facilities, intersection geometry, high traffic volumes in urbanized areas with high volume of trucks and motorcycles from MP 227 - 243
  - US 60|70 from Globe to Superior, MP 227 – 255, high crash rate due to shoulder conditions, shoulder width, high speeds, clear zone slope and obstructions, high traffic volumes.

### Freight Needs

- Freight Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A low level of freight needs was identified on 15 miles (7%) of the US 60| US 70| US 191 corridor and a high level of freight need was identified on 116 miles (54%) of the corridor.
- High level of delay related to the Planning Time Index (PTI) contributed to freight needs for NB/SB US 191 MP 0 – 104, EB/WB US 60 MP 225 – 255, and EB US 70 MP 270 – 255.
- The number of closures on US 60| US 70| US 191 due to incidents/accidents or obstructions/ hazards are above statewide average in the following areas:

- US 191 MP 0 – 67 including flooding at MP 53 and MP 66
- US 191 MP 43 (Border Patrol Check Point)
- Concentration of short term closures due to incidents/accidents at the following locations:
  - Incidents/accidents US 191 MP 115 – 120
  - US 60 from MP 233 – 242,
  - US 60 from MP 228 – 231.7 (with a high concentration of incidents at MP 230), and
  - US 60 from MP 224 – 227
- Significant number of extended duration closures on US 60 from MP 225 – 228
- Mountainous grades with a lack of passing and climbing lanes on US 60 from MP 227 - 243
- Limited passing, acceleration and deceleration on rolling terrain on US 70 MP 255 - 330
- Rock fall on US 60 caused repeated incidents of delay and closures between MP 228 – 248
- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions
- Clearance restrictions exist at Pinal SPRR UP MP 253.63 (No. 562, height of 15.84 feet) and Queen Creek Tunnel MP 228.47 (height of 13.03 feet).

#### Overlapping Needs

Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below.

- Most segments on the corridor have overlapping needs, approximately 205 miles of the 214 miles or 96% of the corridor. The exceptions include Segments 70-8, 70-9 and 60-16. Traffic counters do not exist in Segments 191-4 through 70-11, approximately 75 miles or 35% of the corridor, resulting in insufficient data to calculate needs in the freight performance area for those locations.
- US 191 MP 87 to MP 104 (Segment 191-3) and US 60|70 MP 243 to MP 255 (Segment 70|60-13) have overlapping needs in all five performance areas. These segments comprised 29 of the 214 corridor miles.
- Segment 191-3 has an overall “Medium” need, with some level of need in all performance areas. The greater needs relate to mobility and freight due to high TTI and PTI related to accidents and incidents. A few closures have long durations that impacted the segment need level. Also noteworthy is that this segment is immediately north of I-10 and utilized when traffic is detoured through Safford during I-10 closures.
- Segment 70|60-13 has an overall “High” need and the highest need score in the corridor. Some needs are site specific while others are characteristics of the segment. High bridge needs are related to the Pinal Creek Bridge (No. 36) and Pinal Creek Bridge (No. 266),

which are hot spots due to poor structural ratings and exhibit high repetitive investment. High safety needs are due to the more urbanized area with increased volumes and speeds too fast for conditions. High freight needs are due to TTI and PTI times, as well as the US 60 Pinal SPRR at MP 253.63 had low vertical clearance (15.84 feet).

- Segment 60-14 also registers an overall “Medium” need score on the corridor. This segment has significant grades and subsequently suffers from freight and mobility needs related to delay and incidents/accidents associated with the grade. The segment includes 3 hot spot bridges, all of which have repetitive investment histories. The Queen Creek Tunnel, also located in the segment, affects bridge and freight needs with poor deck ratings and low vertical clearance.

Table ES-3: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)																
	191-1	191-2	191-3	191-4	191-5	70-6	70-7	70-8	70-9	70-10	70-11	70-12	70 60-13	60-14	60-15	60-16	60-17
	MP 0-24	MP 24-67	MP 87-104	MP 104-116	MP 116-121	MP 339-330	MP 330-300	MP 300-298	MP 298-293	MP 293-274	MP 274-270	MP 270-255	MP 255-243	MP 243-227	MP 227-225	MP 225-223	MP 223-212
Pavement	None*	Low	Low	Medium	Medium	Low	Low	None*	None*	Low	None*	None*	Low	Low	None*	None*	None*
Bridge	None*	Medium	Low	Low	None*	Low	Low	None*	None*	None*	Low	Low	High	High	Low	None*	Low
Mobility+	Low	Low	Medium	None*	Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium	None*	None*	None*
Safety+	None*	None*	Low	None*	High	Low	None*	N/A	N/A	High	N/A	High	High	Medium	N/A	N/A	None*
Freight+	High	High	High	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Low	High	Medium	Low	Low	None*
Average Need	0.92	1.38	1.69	0.60	2.00	1.00	0.70	0.43	0.60	1.40	0.83	1.31	2.23	2.00	0.50	0.30	0.38

\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as this study.

+ Identified as an emphasis area for the US 60|US 70|US 191 corridor

Average Need Scale	
None*	< 0
Low	0.1-1.0
Medium	1.0-2.0
High	> 2.0

## STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State’s key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need as addressing these needs will have the greatest effect on corridor performance. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. US 60|US 70|US 191 strategic investment areas (resulting from the elevated needs) are shown in **Figure ES-6**.

### Screening Process

In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures including:

- A project is programmed to address this need
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment issues; these hot spots will likely be addressed through other ADOT programming means
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need; this bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes.
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project)
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need

### Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT’s traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the US 60|US 70|US 191 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

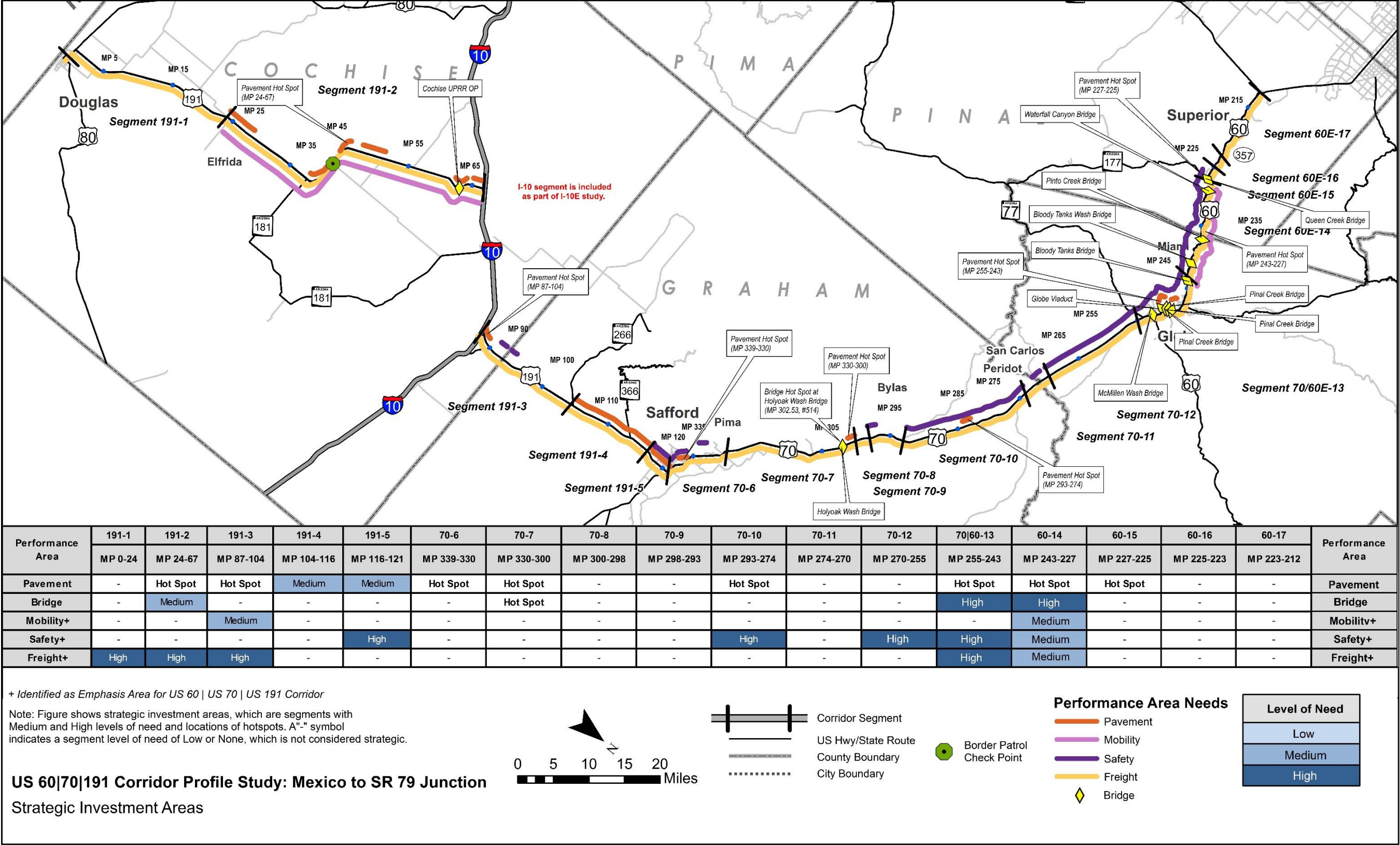
Candidate solutions include some or all of the following characteristics:

- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance areas include two options; rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

Figure ES-6: Strategic Investment Areas



### SOLUTION EVALUATION AND PRIORITIZATION

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation are shown in **Figure ES-7** and described more fully below.

#### Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA eliminates options from further consideration and identify which options should be carried forward for further evaluation.

All Mobility, Safety, and Freight strategic investment areas that result in multiple independent candidate solutions are advanced directly to the Performance Effectiveness Evaluation.

#### Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

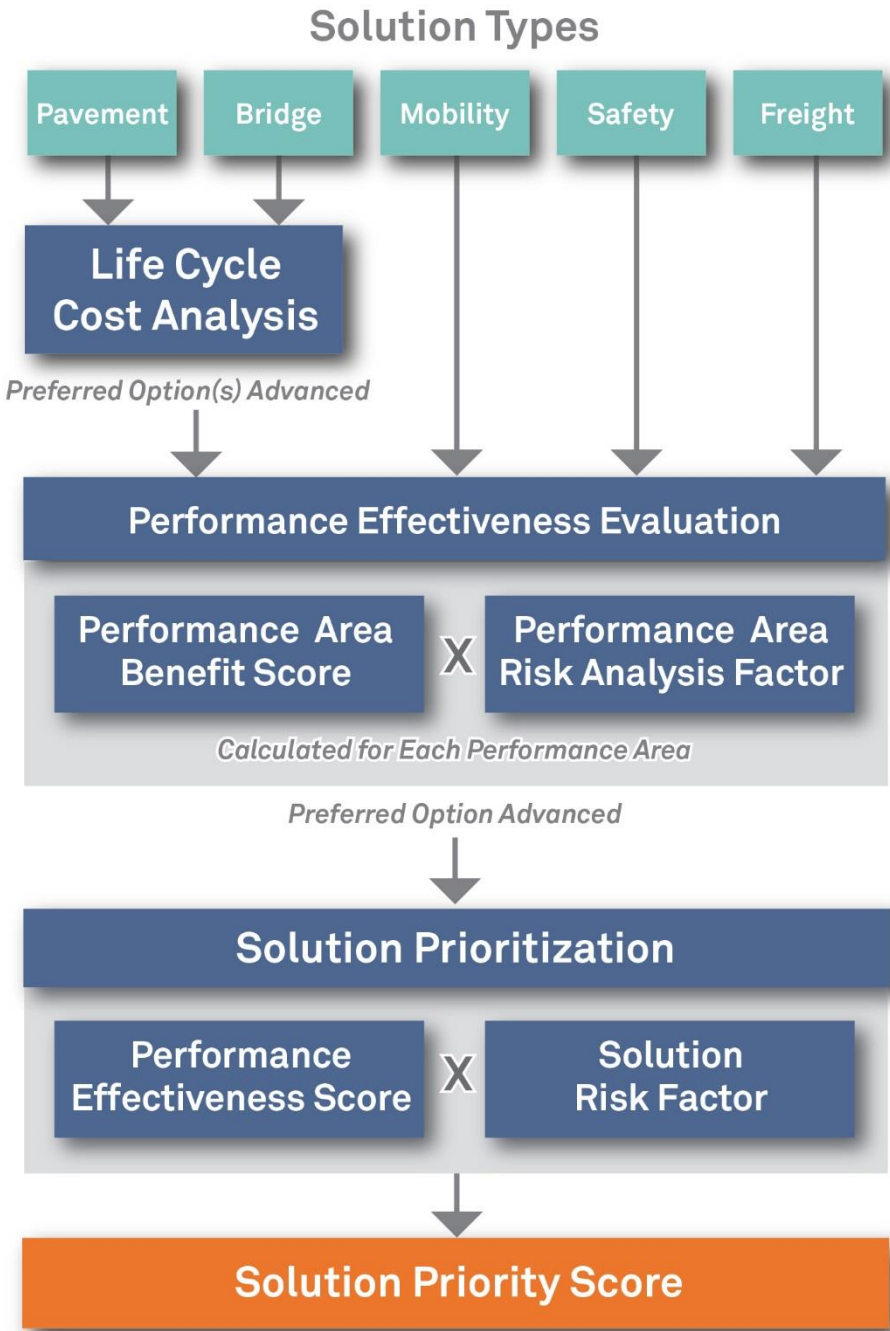
#### Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure.

#### Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are sorted by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure ES-7: Candidate Solution Evaluation Process



## SUMMARY OF CORRIDOR RECOMMENDATIONS

**Table ES-4** and **Figure ES-8** show the prioritized candidate solutions recommended for the US 60|US70|US 191 corridor. These solutions will increase the performance of the US 60|US70|US 191 corridor primarily in the Freight Performance Area. Solutions that address multiple performance areas tend to score higher in this process. Other findings include:

- Most of the anticipated improvements in performance are in the Mobility, Safety, and Freight performance areas
- The highest ranking solutions tended to have overlapping benefits in the Mobility, Safety, and Freight performance areas
- The highest priority solutions address needs in the US 60 Superior to Miami area

### Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor solutions were also identified that are compatible with the long range vision to increase safety and support truck and freight movements:

- Sign Visibility Study in the Safford area along US 191 is recommended to identify locations with potential to improve retroreflectivity
- Road Safety Assessments are recommended in Peridot, Cutter and Globe to identify safety improvements, specifically pedestrian circulation and access needs in Peridot.
- Access Control Studies in Peridot (MP 270 – 274) and Globe-Miami (MP 243 – 255) are recommended to reduce friction and improve safety
- Recommend Superior to Globe Design Concept Study
- Recommend San Carlos Area (MP 268 – 292) Superelevation Study

### Policy and Initiative Recommendations

In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through the CPS process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on US 60|US 70|US 191, but across the entire state highway system where conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic messaging signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects

- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects; in pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is recommended to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

### Next Steps

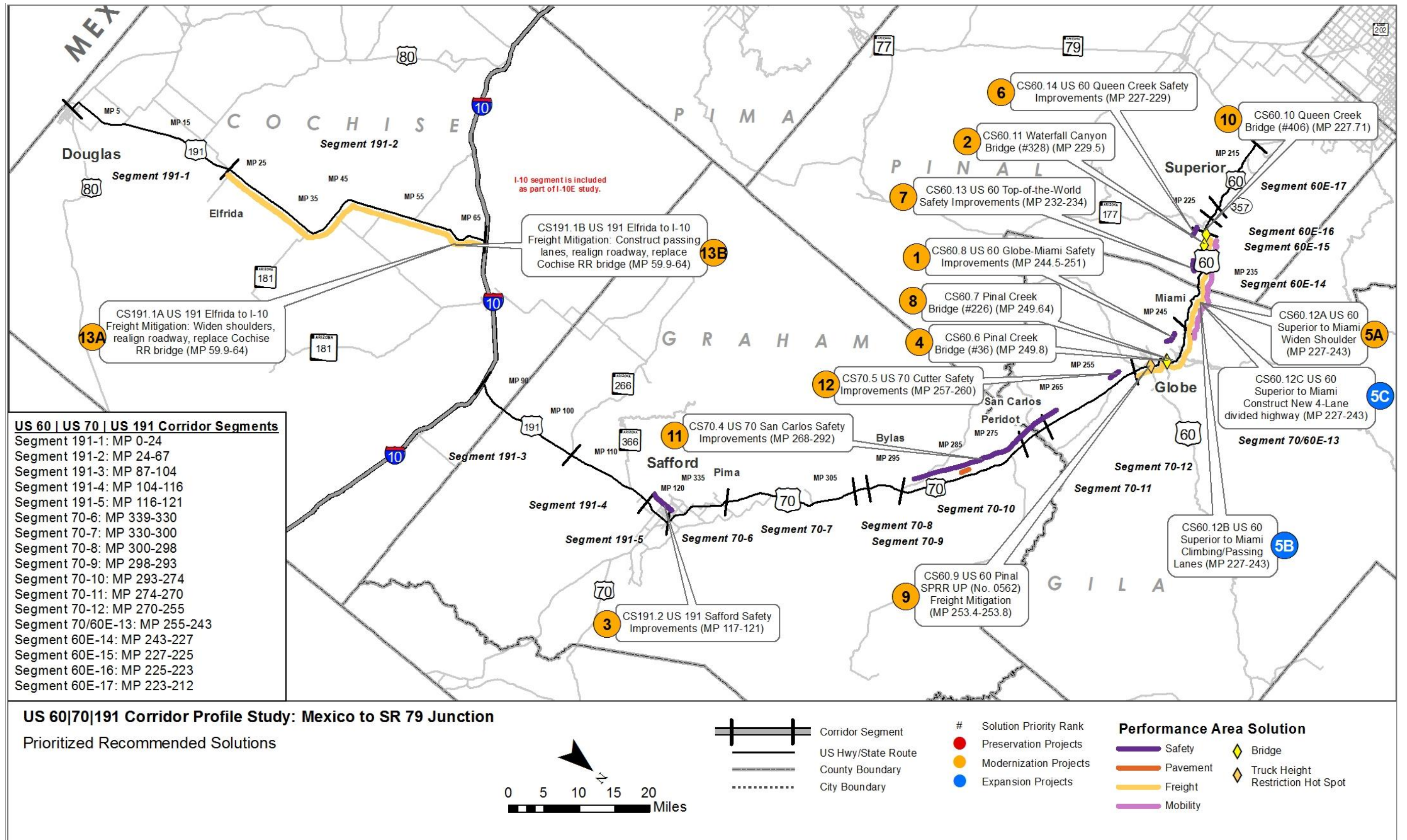
Candidate solutions developed for the US 60|US 70|US 191 corridor will be considered along with other candidate projects in the ADOT statewide programming process. It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendations from such studies are still relevant to addressing the ultimate corridor objectives.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.

**Table ES-4: Prioritized Recommended Solutions**

Rank	Candidate Solution #	Option	Candidate Solution Name	Candidate Solution Scope	Estimated Cost (\$ million)	Investment Category Preservation [P], Modernization [M], Expansion [E]	Prioritization Score
1	60.8	-	US 60 Globe-Miami Safety Improvements	Install lighting Install speed feedback signs (MP 246 - 250) Install warning signs with beacons in advance of SR 188 intersection	\$7.7	M	167
2	60.11	-	US 60 Waterfall Canyon Bridge (#328)	Replace Bridge	\$1.7	M	153
3	191.2	-	US191 Safford Safety Improvements	US 191/Armory Road Intersection: Install Warning Signs with Beacons, Improve Signal Visibility US 191/Discovery Park Intersection: Improve Signal Visibility, Install Dynamic Speed Feedback Signs US 191/Lone Star Intersection: Install Traffic Signal, Install Warning Signs with Beacons US 191/16th Street Intersection: Install Warning Signs with Beacons	\$0.6	M	151
4	60.6	-	US 60 Pinal Creek Bridge (#36)	Replace Bridge	\$2.4	M	109
5	60.12	A	US 60 Top-of-the-World to Superior Widen shoulder	Widen Shoulders (EB MP 227.0 to 227.6, EB MP 227.7 to 228.3, EB MP 228.5 to 232, WB 238.0 to 239.5), Install Rock-Fall Mitigation (WB MP 227.7 to 228, WB MP 233 to 233.3, WB MP 240.2 to 240.4, WB MP 239.5 to 239.45, WB MP 239.6 to 239.75), dynamic weather warning beacons and RWIS. *Note: Queen Creek Tunnel limits omitted from solution (MP 228.3 – 228.5)	\$8.4	M	106
		C	US 60 Top-of-the-World to Superior Construct New 4-lane divided	Construct four-lane divided (using 2 existing-lanes for one direction) (Cost based upon US 60 Superior to Globe Feasibility Study 2014)	\$497.8	E	77
		B	US 60 Top-of-the-World to Superior Climbing/ Passing Lanes	Widen Shoulders (EB MP 227.0 to 227.6, EB MP 227.7 to 228.3, EB MP 228.5 to 232, WB 238.0 to 239.5), Install Rock-Fall Mitigation (WB MP 227.7 to 228, WB MP 233 to 233.3, WB MP 240.2 to 240.4, WB MP 239.5 to 239.45, WB MP 239.6 to 239.75); Install Dynamic Weather Warning Beacons and RWIS	\$66.5	E	73
6	60.14	-	US 60 Queen Creek Safety Improvements	Widen Shoulders; Install Warning Signs, Dynamic Speed Feedback Signs, Centerline Rumble Strip, Guardrail (EB and WB)	\$3.2	M	106
7	60.13	-	US 60 Top-of-the-World Safety Improvements	Install Warning Signs, Dynamic Speed Feedback Signs, High Visibility Edge Line Striping, Centerline Rumble Strip	\$0.2	M	97
8	60.7	-	US 60 Pinal Creek Bridge (#226)	Replace Bridge	\$3.1	M	95
9	60.9	-	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	Re-profile roadway to achieve 16.5 feet vertical clearance	\$0.6	M	67
10	60.10	-	US 60 Queen Creek Bridge (#406)	Replace Bridge	\$8.8	M	58
11	70.4	-	US 70 San Carlos Safety Improvements	Install Centerline Rumble Strip (MP 268-292), Warning Signs with Beacons (MP 278.5, 280, 292), Warning Signs (MP 269, 273), Dynamic Speed Feedback Signs (MP 268, 273, 278.5, 280, 292); Widen Shoulders (MP 270-292); Formalize Pullouts (WB MP 274.5, EB MP 279, EB MP 289, WB 292); Construct Passing Lane (WB MP 282-288 and EB 262-264)	\$57.7	M	57
12	70.5	-	US 70 Cutter Safety Improvements	Install Lighting and Center Turn Lane	\$3.1	M	16
13	191.1	A	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	Realign Roadway, Replace Cochise RR Bridge	\$46.7	M	3
		B	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	Realign Roadway, Construct Passing Lanes (NB and SB), Replace Cochise RR Bridge	\$62.7	M	2

Figure ES-8: Prioritized Recommended Solutions



# 1.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of US Route (US) 60|US 70: State Route (SR) 79 to US 191 and US 191: US 70 to SR 80 (US 60|US 70|US 191). The study examines key performance measures relative to the US 60|US 70|US 191 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven CPS within three separate groupings.

The first three studies (**Round 1**) began in Spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: Nogales to Junction I-10
- I-40: California State Line to I-17

The second round (**Round 2**) of studies, initiated in Spring 2015, include:

- I-8: California State Line to I-10
- I-40: I-17 to New Mexico State Line
- SR 95: I-8 to I-40

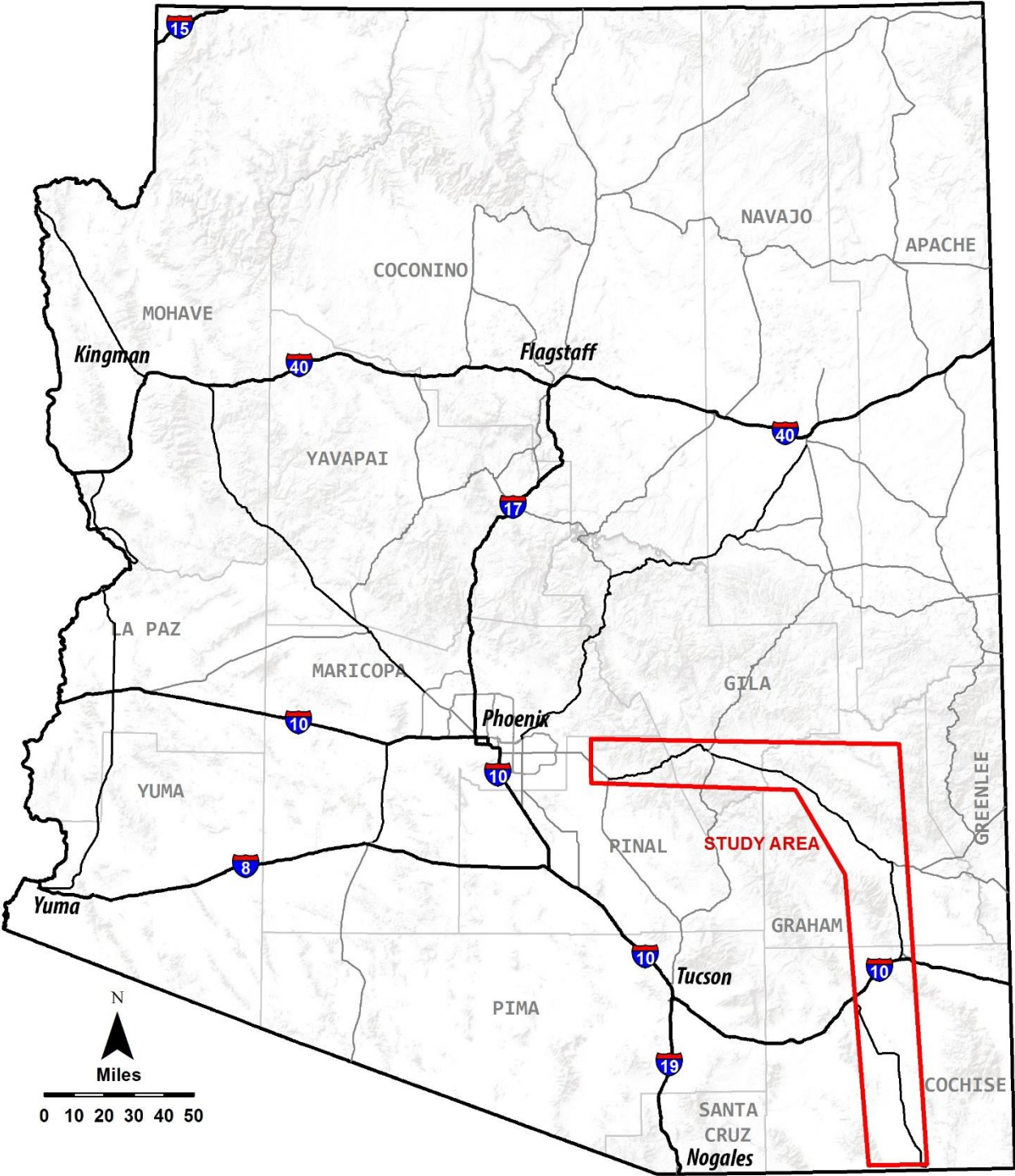
The third round (**Round 3**) of studies, initiated in Fall 2015, include:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 93/US 60: Nevada State Line to SR 303L

The studies under this program assess the overall health, or performance, of the state's strategic highways. The CPS will identify candidate solutions for consideration in the Multimodal Planning Division's (MPD) P2P project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

The US 60|US 70|US 191 corridor, depicted in **Figure 1**, is one of the strategic statewide corridors identified and the subject of this Round 3 CPS.

Figure 1: Corridor Study Area



### 1.1 Corridor Study Purpose

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation

### 1.2 Study Goals and Objectives

The objective of this study is to identify a recommended set of prioritized potential solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The US 60|US 70|US 191 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance. Corridor benefits can be categorized by the following three investment types:

- Preservation: Activities that protect transportation infrastructure by sustaining asset condition or extending asset service life
- Modernization: Highway improvements that upgrade efficiency, functionality, and safety without adding capacity
- Expansion: Improvements that add transportation capacity through the addition of new facilities and/or services

This study identifies potential actions to improve the performance of the US 60|US 70|US 191 corridor. Proposed actions are compared based on their likelihood of achieving desired performance levels, life-cycle costs, and cost effectiveness to produce a prioritized list of solutions that help achieve corridor goals.

The following goals are identified as the desired outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

### 1.3 Corridor Overview and Location

The US 60|US 70|US 191 corridor links the Mexico border at the City of Douglas and the Phoenix metropolitan area to agricultural, mining and recreational activity in southeastern Arizona. The US 60|US 70|US 191 Corridor Profile Study limits extend along US 191 from Douglas to I-10, continuing along US 191 from I-10 to Safford to the junction with US 70, then following US 70 from Safford, passing through the San Carlos Apache Reservation to Globe, and transitioning to the US 60 from Globe, through Superior to Florence Junction at the US 60|SR 79 intersection. In general, all three highways are two-lane facilities designed for relatively modest traffic volumes in a rural setting. At the same time, the corridor offers some unique benefits within the Arizona circulation system that could be leveraged for increased usage as the need arises.

US 191 provides a link between Mexico and Interstate 10 (I-10), the primary east-west interstate corridor along the southern states. As a result, US 191 serves as a major freight corridor for goods moving between Mexico and the United States. Similarly, the combination of US 191 and US 70 between I-10 and Globe offers a critical connection to mining and agricultural interests located in the greater Safford and Globe areas of Graham and Pinal Counties. US 60 between Globe and SR 79 links activities within the corridor to the major population and commerce center of the Phoenix metropolitan area.

The combination of all three highways (US 60|US 70|US 191) creates a potentially significant alternative to I-10 and I-19 for travel in the eastern reaches of Arizona. A seamless connection among the three routes as a reliever could have major implications for improving international, interstate and intrastate trade along with opening access to financial and commercial distribution centers in the Phoenix area. It would also provide enhanced accessibility to tourist and recreational opportunities in southeastern Arizona.

### 1.4 Corridor Segments

The US 60|US 70|US 191 Corridor is divided into seventeen planning segments for analysis and evaluation. These planning segments allow the corridor to be analyzed at a detailed level so that location-specific needs can be readily identified and compared to other segments on this or other corridors. Segmentation by similar characteristics (e.g., urban/rural surroundings, road width, traffic volumes) allowed the analysis to highlight anomalies or instances of poor performance within the context of each segment. The corridor is segmented at logical breaks where context changes such as terrain, daily traffic volumes, or roadway typical section indicate. Additional segment breaks may occur at major intersections or junctions, where the corridor transitions from rural to urban environments, other similar operating environments, maintenance sections, and at jurisdictional changes. Corridor segments are described in **Table 1** and are shown in **Figure 2**.

**Table 1: US 60|US 70|US 191 Corridor Segments**

Segment #	Route	Begin	End	Approximate Begin Milepost	Approximate End Milepost	Approximate Length (miles)	Typical Through Lanes (NB/EB, SB/WB)	2014 (2035) Average Annual Daily Traffic Volume (vpd)	Character Description
191-1	US 191	US 191B Junction	Elfrida	0	24	24	1,1	1,952 (2,652)	Starting from MP 0 along US 191, this segment is primarily rural in nature, but is the only route to the Bisbee-Douglas International Airport.
191-2	US 191	Elfrida	I-10	24	67	43	1,1	1,384 (1,727)	Beginning in Elfrida, a census-designated place, this segment connects smaller agricultural communities to each other and I-10.
191-3	US 191	I-10	SR 266	87	104	17	2,2	2,392 (2,887)	No known developments exist along this segment however, it does connect the Arizona State Prison at Fort Grant to I-10 via SR 266.
191-4	US 191	SR 266	Safford City Limit	104	116	12	1,1	4,584 (5,673)	Land along this segment is primarily owned by the Bureau of Reclamation and is therefore undeveloped. The segment begins at SR 266 and ends at approximately the southern limits of Safford. Traffic numbers in this segment increase due to the development south of Safford.
191-5	US 191	Safford City Limit	US 70 Junction	116	121	5	2,2	8,312 (11,891)	This segment starts at approximately the southern limits of Safford and ends at the junction with US 70. The segment is differentiated by jurisdiction and change in route along the corridor rather than any changes in terrain or traffic.
70-6	US 70	US 191 Junction	Pima	339	330	9	2,2	12,630 (23,399)	Beginning at the junction with US 191 in Safford and ending at the northern limit of Pima, this segment has very high traffic volumes which can be attributed to the higher density of surrounding communities and agricultural/mining operations. A large majority of the land abutting the route is privately owned.
70-7	US 70*	Pima	San Carlos Apache Reservation	330	300	19	1,1	3,506 (4,647)	This segment connects the western limit of Pima to the eastern edge of the San Carlos Apache Reservation. A majority of the land abutting US 70 is privately owned and used for agricultural purposes. Milepost equation MP 314.21 Back = MP 325.31 Ahead occurs within this segment.
70-8	US 70	San Carlos Apache Reservation	Bylas	300	298	2	1,1	3,295 (4,932)	Beginning at the eastern limits of the San Carlos Apache Reservation, this short segment terminates at the eastern limits of Bylas.
70-9	US 70	Bylas	Bylas	298	293	5	1,1	3,295 (4,495)	Bylas is a census-designated place within the San Carlos Apache Reservation. The boundary of this segment was determined by the extent of development and not necessarily the jurisdictional limits.
70-10	US 70	Bylas	Peridot	293	274	19	1,1	3,295 (4,504)	This segment begins at the western extent of development in Bylas and extends to the eastern limits of development in Peridot. The segment is within the San Carlos Reservation and has low traffic volume.

AADT = Average Annual Daily Traffic

vpd = vehicles per day

\*Milepost equation MP 314.21Back = MP 325.31

**Table 2: US 60|US 70|US 191 Corridor Segments (continued)**

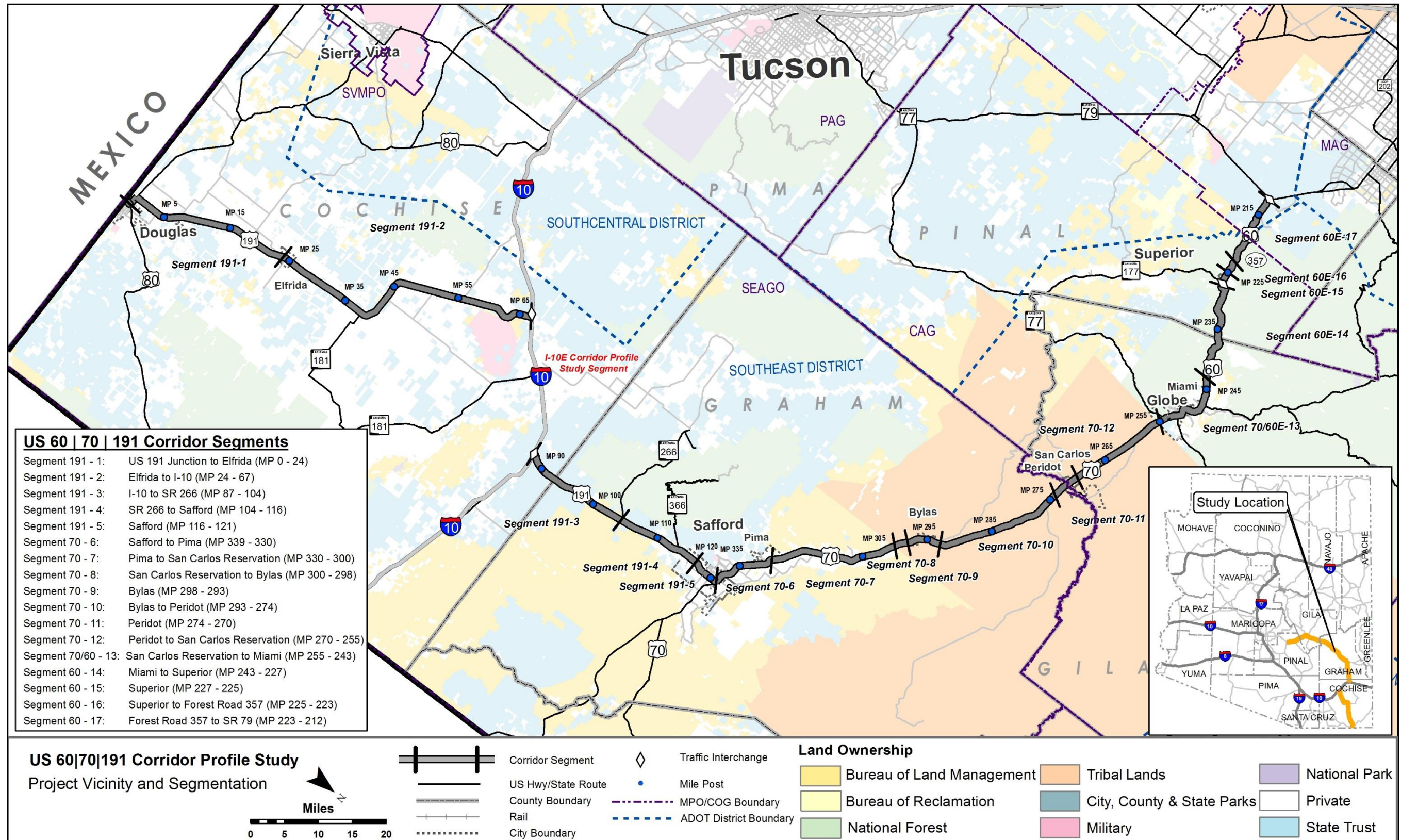
Segment #	Route	Begin	End	Approximate Begin Milepost	Approximate End Milepost	Approximate Length (miles)	Typical Through Lanes (NB/EB, SB/WB)	2014 (2035) Average Annual Daily Traffic Volume (vpd)	Character Description
70-11	US 70	Peridot	Peridot	274	270	4	1,1	3,295 (5,355)	The segment starts at the new medical center at the eastern limits of Peridot and extends west to the high school. It is differentiated by Graham/Gila County jurisdiction rather than changes in terrain or traffic.
70-12	US 70	Peridot	San Carlos Apache Reservation	270	255	15	1,1	4,230 (6,359)	Beginning at the Peridot High School and continuing to the western limit of the San Carlos Apache Reservation, this segment is differentiated by jurisdiction rather than any changes in terrain or traffic.
70 60-13	US 70/US 60	San Carlos Apache Reservation	Miami	255	243	12	2,2	11,008 (14,619)	Beginning at the western limits of the San Carlos Apache Reservation, this segment goes through the City of Globe, Claypool and Miami. Although this segment includes US 70 and US 60, there is no change in cross section therefore, the segment is differentiated by jurisdiction rather than any other changes. Higher traffic counts are due to the junction of US 60 and US 70 along with higher traffic counts and the proximity of large mines.
60-14	US 60	Miami	Superior	243	227	16	1,1	9,069 (14,176)	Beginning at the western limits of Miami and extending to the eastern limits of Superior, this segment bisects the Tonto National Forest. The high traffic volume can be attributed to a significant number of regular commuters in both directions (Valley to Globe) and tourist traffic.
60-15	US 60	Superior	Superior	227	225	2	1,1	7,781 (17,588)	This segment starts and ends at approximately the eastern and western limits of Superior. This segment is differentiated by jurisdiction rather than any changes in terrain or traffic.
60-16	US 60	Superior	Forest Road 357	225	223	2	1,1	7,781 (14,924)	This segment is bounded by the Tonto National Forest and is differentiated by the number of thru east and west lanes rather than changes in terrain or jurisdiction.
60-17	US 60	Forest Road 357	SR 79	223	212	11	1,1	9,547 (18,273)	Although this segment is generally flat in nature, it is differentiated by the number of thru lanes, compared to 60-16. Beginning at State Forest Road 357, this segment terminates at the interchange with SR 79.

AADT = Average Annual Daily Traffic

vpd = vehicles per day

\*Milepost equation MP 314.21Back = MP 325.31

Figure 2: Corridor Location and Segments



## 1.5 Corridor Characteristics

The US 60|US 70|US 191 corridor provides primary access to agriculture, mining and recreation areas in the southeastern part of Arizona. The corridor intersects I-10, which provides east and west access to and from the corridor. Beginning in Douglas, just north of the international border, the corridor extends northwest through Safford to Florence Junction, at the edge of the Phoenix metropolitan region, providing a key economic and recreational link in the region and state.

### National Context

The southern and northern portions of the corridor both provide connectivity to the national transportation network. The southern portion of the corridor, US 191 south of I-10, provides a link between Mexico and I-10, the main east-west corridor along the southern states. As a result, US 191 serves as a major freight corridor for goods moving between Mexico and the US. The portion of the corridor north of I-10 provides connectivity between major mining and agricultural areas, linking to I-10 for national distribution.

### Regional Connectivity

The combination of US 191 and US 70 between I-10 and Globe offers a critical connection to mining and agricultural interests located in the greater Safford and Globe areas of Graham and Pinal Counties. US 60 between Globe and SR 79 ties all the activities within the corridor, along with additional mining and recreational opportunities along US 60, to the major population and commerce center of the Phoenix metropolitan area.

### Commercial Truck Traffic

The US 60|US 70|US 191 corridor serves as an important route for agricultural products grown in the Gila River Valley, and for large mining operations near Safford, Miami and Superior. According to ADOT's 2014 Highway Performance Monitoring System (HPMS) data, the average daily commercial truck volumes along the corridor range from less than 100 to nearly 700 trucks per day. Segments with volumes over 250 daily commercial trucks include Segments 191-4 through 191-6, Segment 70|60-13 through 60-15 and Segment 60-17. The high volume of trucks on these segments can be attributed to the large active mines in the Safford and Globe areas, as well as agricultural shipments. Due to the nature of truck traffic, oversize loads are common on this corridor.

The Douglas Port of Entry (POE) is located at the southern end of the corridor. In 2014, this crossing was the second busiest port in Arizona in terms of total number of loaded truck containers, accounting for approximately 9% of all truck crossings within the State. One inspection station is located adjacent to northbound US 191 at MP 1 and includes a weigh-in-motion scale. One permanent border checkpoint is located just north of Elfrida, on northbound US 191 in Segment 191-2. This location requires all vehicles to stop for inspection, which can create some delay with commercial truck traffic.

### Commuter Traffic

Commuter traffic on US 60|US 70|US 191 occurs mostly within the urbanized areas of Safford, Globe and Superior, which are the primary economic centers along the corridor. According to the most recent traffic volume data maintained by ADOT, traffic volumes range from approximately 12,500 vehicles per day in the Safford area to approximately 8,000 vehicles per day in the Superior area. Other less urbanized areas, including Elfrida, Bylas and Peridot, average traffic volumes are between 1,000-4,000 vehicles per day.

According to the 2014 5-Year American Community Survey data from the US Census Bureau, 67% of the workforce in the City of Safford, 75% of the workforce in the City of Globe and 80% of the workforce in the Town of Superior drove alone for their daily commutes. Carpooling accounted for 12%-24% of daily commuters. As there are limited transit options in this area, less than 1% of daily commuters used public transportation as a means to get to work. The average commute travel time for these areas is 15-25 minutes. In the less populated areas of Bylas, Elfrida and Miami, there is a lower percentage of the population commuting to work alone, averaging 69%. In Bylas, 10% of commuters used public transportation. Nine percent of daily commuters in Elfrida and 12% of commuters in Miami carpoled. The average commute travel time for these less populated areas is similar to the larger urban areas, 15-25 minutes.

### Recreation and Tourism

US 60|US 70|US 191 provides access to many recreational opportunities within the southeastern area of the state, including National Forest, wildlife areas, tribal recreation areas, and parks. The corridor provides access to both the Coronado and Tonto National Forests. The Coronado National Forest is broken up by the National Forest Service into different Ecosystem Management Areas, defined by each mountain range. The Dragoon, Pinaleno and Santa Teresa Ecosystem Management Areas are primarily accessed via US 191 or US 70. Segments 70|60-13 through 60-17 bisect the Tonto National Forest and can be used to access the Salt River and Superstition Mountains via SR 188.

There are numerous other natural areas and parks along the corridor. The Leslie Canyon National Wildlife Refuge is located east of US 191 between Douglas and Elfrida and encompasses over 2,700 acres. The Refuge was established in 1988 to protect two native fish species of the Rio Yaqui watershed. Located west of US 191 between Douglas and Elfrida is the Whitewater Draw Wildlife Area, which is comprised of 1,500 acres and home to over 20,000 Sandhill Cranes during the winter. The park is open from October 15 through March 15.

Mount Graham is located southwest of Safford and is accessible via US 191. Recreational activities include hiking, rock climbing and cross country skiing. In addition to these opportunities, the Mount Graham is home to the University of Arizona Steward Observatory. The observatory was established in 1916 however construction was delayed due to World War I. By 1963, the original 36" diameter telescope was replaced with a smaller one due to the increased light pollution from the expanding Tucson area.

Coolidge Dam and San Carlos Lake are located west of US 70 just south of Peridot. Built between 1924 and 1928, the Coolidge Dam was part of the San Carlos Irrigation Project and is responsible for irrigating 100,000 acres of agricultural land. Recreational uses within the area include fishing and boating on San Carlos Lake and hiking/biking on a 13 mile route along the dam’s access road.

The Apache Gold Casino and Resort in Globe is located along Highway. Owned by the San Carlos Apache Tribe the casino includes 600 slot machines, and 200-seat bingo hall, a golf course, 145-room resort with a conference center and an RV park.

The Boyce Thompson Arboretum and State Park is located off of US 60 in Superior. Founded in the 1920’s, the park is Arizona’s oldest and largest botanical garden encompassing 323-acres and includes over three miles of paths and trails.

In addition to the recreational amenities already mentioned, there are numerous trailheads along the corridor which are accessible through informal pull off areas.

Multimodal Uses

Besides commuter and freight traffic, as previously discussed, the US 60 US 70 US 191 corridor also accommodates alternative modes of transportation. The following section will discuss the existing multimodal options connecting communities along the corridor to each other and the surrounding region.

*Freight Rail*

The Arizona Eastern Railroad (AZER) extends from Miami to Lordsburg, New Mexico and Clifton to Lordsburg. The line from Miami to Lordsburg follows the Gila River until Bylas, then parallels US 70 into the Safford area, extending from Segment 191-5 through US 70|60-13. There are three at grade crossings along the corridor. The crossings are located at US 191 near MP 121 in Safford, and MP 246 and MP 247 near Miami. Commodities transported include copper, chemicals, and agricultural and forest products.

There is one additional at grade rail road crossing along the corridor. The Magma Arizona Railroad crosses US 60 near MP 215.

*Passenger Rail*

The “Copper Spike Extension”, which traveled from Globe to the Apache Gold Casino Resort on the San Carlos Indian Reservation, was previously used for passenger train service. In 2011, ownership of the line transferred and the line was abandoned

*Bicycles/Pedestrians*

Cyclists may use state highways unless specifically prohibited, although a majority of the corridor has an effective shoulder width of less than 10 feet on either side. Only Segments 191-3 and 60-17 have shoulder widths greater than 10 feet. Sidewalks are located along portions of the corridor within the urbanized areas. A pedestrian bridge at Fort Thomas provides a grade separated

crossing of US 70. Additionally, within the areas of Bylas and Peridot, pedestrian facilities are not continuous on both sides of the roadway and drainage features create discontinuity in the informal, unpaved pedestrian network in these areas. Also, fencing along the roadway in Bylas and Peridot limits pedestrian crossing opportunities, although there are breaks in the fencing. Unpaved trails can also be found along the corridor and are served by informal pullouts.

*Bus/Transit*

Within the study area there are limited public transit opportunities. There are two local public transportation service providers along the US 60|US 70|US 191 corridor. The San Carlos Apache Nnee Bich’o Nii Public Transit Service provides buses between Safford and Globe with stops in Thatcher, Pima, Fort Thomas, Bylas, Peridot and Globe. There are three routes with an additional Casino Employee Shuttle. Fares range from \$2.00-\$10.00 round trip. The second service provider is the Cobre Valley Community Transit which serves Miami, Globe and unincorporated portions of Gila County. There are two routes between Miami and Globe, operating Monday through Friday 6:30am to 6:00pm. One way fares are \$1.00. The transit provider also offers a Dial-a-Ride service with fares ranging from \$1.00-\$4.00, depending on distance.

While existing public transportation service providers may currently be limited, several recent planning documents and studies have identified the need to increase intercity and intracity public transit options along the corridor.

No Greyhound or Amtrak stations are located along the corridor. Private shuttle service provides transportation from Safford to Willcox, Benson, Tucson International Airport and Phoenix Sky Harbor Airport.

*Aviation*

Municipal airports along the corridor are located in Douglas, Safford, San Carlos, and Superior. The Bisbee Douglas International Airport located along US 191 in Douglas is owned by Cochise County and averages 54 aircraft operations per day. Thirty percent of daily operations are military-related and the remainder is general aviation. The Safford Regional Airport is located northeast of the corridor within Safford city limits. The airfield averages 38 aircraft operations per day. The San Carlos Apache Airport is located along US 70 in Globe. It is owned by the San Carlos Apache tribe and averages 36 aircraft operations per week. The Superior Municipal Airfield is located along US 60 near the western boundaries of the town. The airfield averages 200 aircraft operations per year.

Land Ownership, Land Uses and Jurisdictions

As shown **Table 2**, the corridor crosses multiple jurisdictions and land holdings throughout Cochise, Graham, Gila and Pinal Counties. A majority of the land directly abutting the corridor is privately owned. In the vicinity of the corridor, but not immediately adjacent to it, there are significant Bureau of Reclamation, State Trust and National Forest lands.

### Population Centers

The major population centers within the US 60|US 70|US 191 corridor are centered around the urbanized areas of Douglas, Safford, Globe and Superior. Table 2 provides a summary of the U.S. Census population for the communities along the corridor. The local municipalities saw little change in population between 2010 and 2014, where several of these municipalities actually decreased in population during the same timeframe. At the county level, the population shift was more noticeable, especially for Cochise and Pinal County. The populations in the communities along the corridor fluctuate significantly with market demands related to mining and agriculture activities. Looking at the projected 2040 population, Douglas, Safford and Bylas will experience the greatest growth. During the same time period, Cochise and Pinal County will also see a large population shift. However, the growth is not focused in the areas along the study corridor.

### Major Traffic Generators

Along the corridor, major traffic generators are related to mining and agriculture activities, as well as recreation and local commuter traffic in the urbanized areas of Douglas, Safford, Globe and Superior. Outside of the study area, major traffic generators include the Douglas Port of Entry, which generates significant freight traffic that utilizes US 191 to access I-10. Traffic generated from agricultural activities fluctuates seasonally. Mining related traffic experiences significant fluctuations as mining activity varies based on the global price of copper.

There are currently operational mines in Superior, Globe-Miami, and north of Safford, with plans for increases in mining activity in the vicinity of Superior. These mining activities generate traffic related to employment, and induced activity related to the increase in population in the local communities. In some cases, shift workers may live temporarily in housing near the mine while their families live in another community, where the mine workers commute home on off days. Due to the shift work related to the mines, there are not typical peak-hour and weekday commute patterns. The mines also generate significant truck traffic, including oversized loads related to mining equipment.

### Tribes

Segments 70-8 through 70-12 bisect the San Carlos Apache Reservation.

### Wildlife Linkages

The Arizona State Wildlife Action Plan (SWAP) provides a 10-year vision for the entire state, identifying wildlife and habitats in need of conservation, insight regarding the stressors to those resources, and suggested actions that can be taken to alleviate those stressors. Using the HabiMap Tool developed by Arizona Game and Fish Department (AGFD), which is an interactive database of the information included in the SWAP, the following wildlife considerations were identified in relation to the US 60|US 70|US 191 corridor:

- Wildlife waters are located to the north of US 60 near Superior and on both sides of US 191 between Safford and I-10

**Table 3: Current and Future Population**

Community	2010 Population	2015* Population	2040 Population	% Change 2010-2040	Total Growth
<b>Cochise County</b>	<b>131,346</b>	<b>134,166</b>	<b>173,377</b>	<b>32%</b>	<b>42,031</b>
Douglas	17,378	16,974	20,447	18%	3,069
Elfrida	459	285	-	-	-
<b>Graham County</b>	<b>37,220</b>	<b>38,569</b>	<b>51,887</b>	<b>39%</b>	<b>14,667</b>
Safford	9,566	9,627	12,006	26%	2,440
Pima	2,387	2,428	3,171	33%	784
Bylas	1,962	2,069	2,909	48%	947
Peridot	973	1,026	1,443	48%	470
<b>Gila County</b>	<b>53,565</b>	<b>54,148</b>	<b>58,735</b>	<b>10%</b>	<b>5,170</b>
San Carlos	4,038	4,059	4,220	5%	182
Globe	7,533	7,544	8,092	7%	559
Miami	1,837	1,837	1,837	0%	0
<b>Pinal County</b>	<b>376,369</b>	<b>414,999</b>	<b>934,939</b>	<b>148%</b>	<b>558,570</b>
Superior	2,835	2,952	3,830	35%	995

Source: U.S. Census, Arizona Department of Administration – Employment and Population Statistics

- Willcox Playa/Cochise Important Bird Area is located along the eastern side of US 191 from approximately MP 60 continuing north to I-10
- A majority of the US 60|US 70|US 191 corridor bisects allotments/pastures, except along US 70 on the San Carlos Reservation and along US 191 south of US 181
- State Land holdings exist within the corridor, primarily along US 191 between Safford and I-10
- US Forest Service Land is located along US 60 and US 70 between SR 79 and SR 77
- Potential Wildlife Linkages exist along US 60 between SR 79 and SR 77 and along US 191 between SR 366 and I-10
- The Species and Habitat Conservation Guide indicates sensitive habitats exist along the corridor except a portion of US 70 which bisects the San Carlos Reservation
- “Species of Greatest Conservation Need” are identified along the corridor except a portion of US 70 which bisects the San Carlos Reservation
- A moderate level of “Species of Economic and Recreational Importance” are identified along the corridor except a portion of US 70 that bisects the San Carlos Reservation

### Corridor Assets

The US 60|US 70|US 191 corridor links regionally important communities in the southwestern part of the state to Mexico, I-10 and the Phoenix metropolitan area. The southern portion of US 191 connects the Douglas Port of Entry to I-10 and is an important route for freight. The corridor is also a vital route between the large mining and agricultural activities within the Gila River Valley and the rest of the state. The Transportation Assets Map (Figure 3) shows key features that are available to the travelling public today.

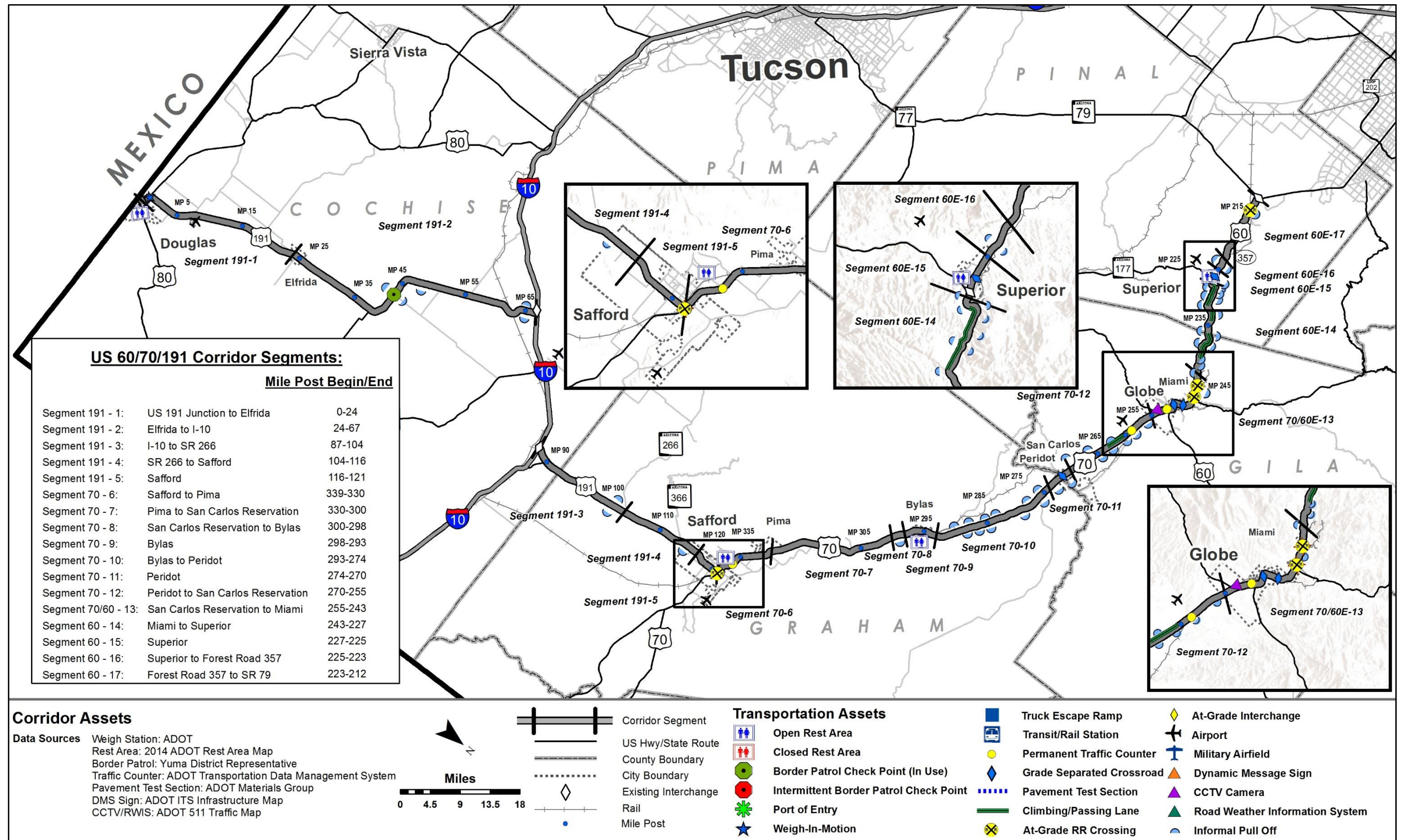
Limited public transportation services are offered within the region. These services either don't span the entire corridor or are only operated on a limited basis. While population changes have not been significant over the last few years, numerous transportation studies have identified a need for intercity and intracity transit services along the corridor.

The majority of assets are located along the most densely populated portions of the corridor near the Safford and Globe areas. In addition to the one Border Patrol check point, one weigh-in-motion scale and four public rest stops already discussed, there are three permanent traffic counters along the corridor, located at MP 337 and MP 254 on US 70 and MP 252 on US 60. There is one short climbing/passing lane for eastbound traffic on US 70 in Segment 70-12, while Segment 60-14 has numerous climbing and passing lanes for both directions. There are several grade-separated crossroads and at-grade railroad crossings along the corridor but they are primarily located near the urbanized areas.

Along the US 60|US 70|US 191 corridor ADOT operates four rest areas. The Douglas Rest Area is located at the southwest corner of US 191 and SR 80 at MP 0. The Safford Park Rest Area is located along the east side of US 70 at MP 338. The third rest area is the Bylas Rest Area along the west side US 70 at MP 296. The fourth rest area is the Superior Rest Area located along the east side of US 60 at MP 226 and serves the eastbound traffic. There are also a number of informal pullouts along the corridor.

There is one closed circuit television (CCTV) camera located along US 70 east of Globe to monitor traffic, as well as one dynamic message sign in the same vicinity currently in design.

Figure 3: Corridor Assets



## 1.6 Corridor Stakeholders and Input Process

A Technical Advisory Committee (TAC) was created, which was comprised of representatives from key stakeholders. TAC meetings were held at key milestones to present results and obtain feedback. In addition, several meetings were also conducted with key stakeholders between October 2015 and December 2016.

Key stakeholders for this study include:

- South Eastern Arizona Governments Organization (SEAGO)
- Central Arizona Governments (CAG)
- ADOT Southeast District
- ADOT South Central District
- ADOT Technical Groups
- Arizona Game and Fish Department (AGFD)
- Arizona State Land Department (ASLD)
- Federal Highway Administration (FHWA)

Several Working Papers were developed during the course of the CPS. The Working Papers were provided to the TAC for review and comment.

## 1.7 Prior Studies and Recommendations

This section provides a summary of previous studies and plans and their recommendations that are relevant to the IUS 60|US 70|US 191 CPS.

### Framework and Statewide Studies

- ADOT Bicycle and Pedestrian Plan Update
- ADOT Five-Year Transportation Facilities Construction Program 2016 - 2020
- ADOT Climbing and Passing Lane Prioritization Study
- Arizona Key Commerce Corridors
- Arizona Multimodal Freight Analysis Study
- Arizona Ports of Entry Study
- Arizona State Airports System Plan
- Arizona State Rail Plan
- Arizona Statewide Dynamic Message Sign Master Plan
- Arizona Statewide Rail Framework Study
- Arizona Statewide Shoulders Study
- Arizona Roadway Departure Safety Implementation Plan (RDSIP)
- Arizona Wildlife Action Plan / Arizona Wildlife Linkages Assessment
- Building a Quality Arizona (BQAZ)
- Eastern Arizona Framework Study
- FHWA Freight Analysis Framework
- MAG 2035 RTP
- What Moves You Arizona? Long-Range Transportation Plan 2010-2035

### Regional Planning Studies

- Arizona – Sonora Border Master Plan
- Bi-National Border Transportation Infrastructure Needs Study
- Gila County Rail Passenger Study
- Graham County Transit Feasibility Study
- Pinal County Comprehensive Plan Update
- Pinal County Open Space and Trails Master Plan
- Pinal County Regionally Significant Routes for Safety and Mobility Study
- Pinal County Transit Feasibility Study
- Pinal Creek Trail Conceptual Plan
- Safford General Plan
- SEAGO Transportation Coordination plan Update
- SR 80 & US 191 Oversized Load Study

### Planning Assistance for Rural Areas (PARA) and Small Area Transportation Studies (SATS)

- Cobre Valley Comprehensive Transportation Study
- City of Douglas Small Area Transportation Study
- Gila County Small Area Transportation Study
- Gila County Transportation Study
- Graham County Alternate Route Study
- Graham County/ Safford/ Thatcher/ Pima Small Area Transportation Study
- San Carlos Apache Tribe Transit Feasibility Study

### Design Concept Reports (DCR) and Project Assessments (PA)

- US 60 Florence Junction – Superior DCR
- US 60 Superior – Globe Feasibility Study
- US 60 Superior – Globe Scoping (MP 222 – MP 258)
- US 70 Bylas Road Safety Assessment
- US 70 Segment 1 Pima – Thatcher Final DCR
- US 70 Segment 2 Thatcher – Safford Final DCR
- US 191 Douglas to I-10 Final DCR
- US 191 I-10 to SR 266 Final DCR
- US 191 Jct SR 266 to US 70 Final Corridor Selection Report
- US 191 Whitewater Draw to Thompson Rd Final DCR
- US 60 Passing Lanes (Miami-Superior) Final PA

**Table 3: Corridor Recommendations from Previous Studies**

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Name of Study
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)	
1	2	2	0	DMS sign north and southbound		√				N	Arizona Statewide DMS Plan
2	7	N/A	N/A	Bisbee Douglas International Airport improvements	√			2017-2019		N	ADOT Five Year Program
3	67.5	67.5	0	Reconstruct interchange with I-10		√				N	Arizona Key Commerce Corridors
4	87	121	34	Reconstruct to 4 lane divided highway I-10 to US 70			√			N	BQAZ Eastern Arizona Framework Study
5	90	90	0	DMS sign southbound		√				N	Arizona Statewide DMS Plan
6	104	121	17	Alternate Route			√			N	Graham County SATS/US 191 Alternative Route Study/US 191 Jct. SR 266 to US 70 Corridor Selection
7	104.6	121	16.4	Local public transit service		√				N	Graham County SATS
8	110.9	116	5.1	Restripe to 5 lanes between Artesia Road and Lebanon Road			√	2018-2023		N	Graham County SATS
9	110.9	118	4.4	Widen to 4 lanes between Artesia Road and Armory Road			√	2008-2013		N	Graham County SATS
10	114	114	0	SR 366 and Swift Trail Road Intersection Improvement		√		2008-2013		N	Graham County SATS
11	114	118	4	Pavement preservation	√			2016		Y	ADOT Five Year Program
12	116	116	0	DMS sign northbound		√				N	Arizona Statewide DMS Plan
13	118	118	0	Armory Road Intersection Improvement		√		2008-2013		N	Graham County SATS
14	119	119	0	Discovery Park Boulevard Intersection Improvement		√		2008-2013		N	Graham County SATS
15	120	121	1	Restripe to 5 lanes between 11 <sup>th</sup> Street and US 70			√	2008-2013		N	Graham County SATS
16	121	N/A	N/A	Extend Highway North US 70 to 8 <sup>th</sup> Street			√	2018-2023		N	Graham County SATS
17	121	N/A	N/A	Safford Regional Airport improvements	√	√	√	2016 - 2020		N	ADOT Five Year Program

**Table 3: Corridor Recommendations from Previous Studies (continued)**

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Document
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)	
18	339	339	0	Intersection Improvement		√		2008-2013		N	Graham County SATS
19	339	338	1	Safety /Intersection Improvements		√		2018		N	ADOT Five Year Program
20	339	328	11	Provide enhanced local transit in Safford/Pima/Thatcher			√			N	Eastern Arizona Framework Study Graham County Transit Feasibility Study
21	339	328	11	Provide Complete Streets in Safford/Pima/Thatcher		√				N	Eastern Arizona Framework Study
22	339	253	86	Widen roadway to 4 lanes between US 191 and Globe			√			N	Eastern Arizona Framework Study/BQAZ
23	337	337	0	Intersection Improvement		√		2008-2013		N	Graham County SATS
24	335.8	335.8	0	Intersection Improvement		√		2008-2013		N	Graham County SATS
25	335.7	335.7	0	Intersection Improvement		√		2008-2013		N	Graham County SATS
26	335.6	335.6	0	Intersection Improvement		√		2008-2013		N	Graham County SATS
27	335.5	335.5	0	Traffic signal or roundabout		√		2008-2013		N	Graham County SATS
28	330	329	1	Construct Pedestrian Bridge Extension		√		2017	H8397 01C	Y	ADOT Five Year Program
29	312.25	312.25	0	Add Center Turn Lane Bryce-Eden Road			√			N	Graham County SATS
30	300	299	1	Bridge Replacement and Rehabilitation	√			2016	H8547 01C	Y	ADOT Five Year Program
31	300	291	9	Pathway, entry monument and intersection improvements		√		2016	H8031 01C H7637 01C	Y	ADOT Five Year Program
32	298	294	4	Construct continuous two-way left turn lane			√			N	Road Safety Assessment US 70
33	298	294	4	Install street name signs for all intersections		√				N	Road Safety Assessment US 70
34	298	294	4	Evaluate 50 MPH speed limit		√				N	Road Safety Assessment US 70

**Table 3: Corridor Recommendations from Previous Studies (continued)**

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Document
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)	
35	298	294	4	Pedestrian Safety improvements – Pedestrian crossings, warning signs/flashing lights, ADA compliant pedestrian gates		√				N	Road Safety Assessment US 70
36	297.7	296.5	1.1	Eliminate passing zone through Bylas		√				N	Road Safety Assessment US 70
37	297	294	3	Repair 4 street lights west of rest area, 3 lights between MP 294 and 295 and 1 between MP 267 and 297		√				N	Road Safety Assessment US 70
38	296.5	296.5	0	Curb installation on north side of US 70		√				N	Road Safety Assessment US 70
39	296.5	296.5	0	Realign intersection		√				N	Road Safety Assessment US 70
40	295.5	294.6	0.9	Eliminate passing zone through Bylas		√				N	Road Safety Assessment US 70
41	288	282	6	Tier 2 priority westbound climbing lane		√				N	ADOT Climbing and Passing Lane Prioritization Study
42	288	281	7	Tier 2 priority westbound passing lane		√				N	ADOT Climbing and Passing Lane Prioritization Study
43	271	269	2	Construct passing lanes		√		2018		N	ADOT Five Year Program
44	271	251	20	Passenger rail service along Arizona Eastern Railway from Globe to San Carlos			√			N	Gila County Rail Passenger Study
45	270	267	3	Tier 2 priority east and westbound passing lane		√				N	ADOT Climbing and Passing Lane Prioritization Study
46	264	262	2	Tier 2 priority eastbound climbing lane		√				N	ADOT Climbing and Passing Lane Prioritization Study
47	259	259	0	San Carlos Apache Airport improvements	√	√	√	2016 - 2020		N	ADOT Five Year Program
48	254	254	0	Intersection Study at SR 70 and SR 77		√		2015		N	Cobre Valley Comprehensive Transportation Study
49	254	235.5	0.5	Widen to four-lane roadway		√	√	2020		N	Cobre Valley Comprehensive Transportation Study
50	253.75	253.75	0	Rehabilitate Southern Pacific bridge		√		2020		N	Cobre Valley Comprehensive Transportation Study

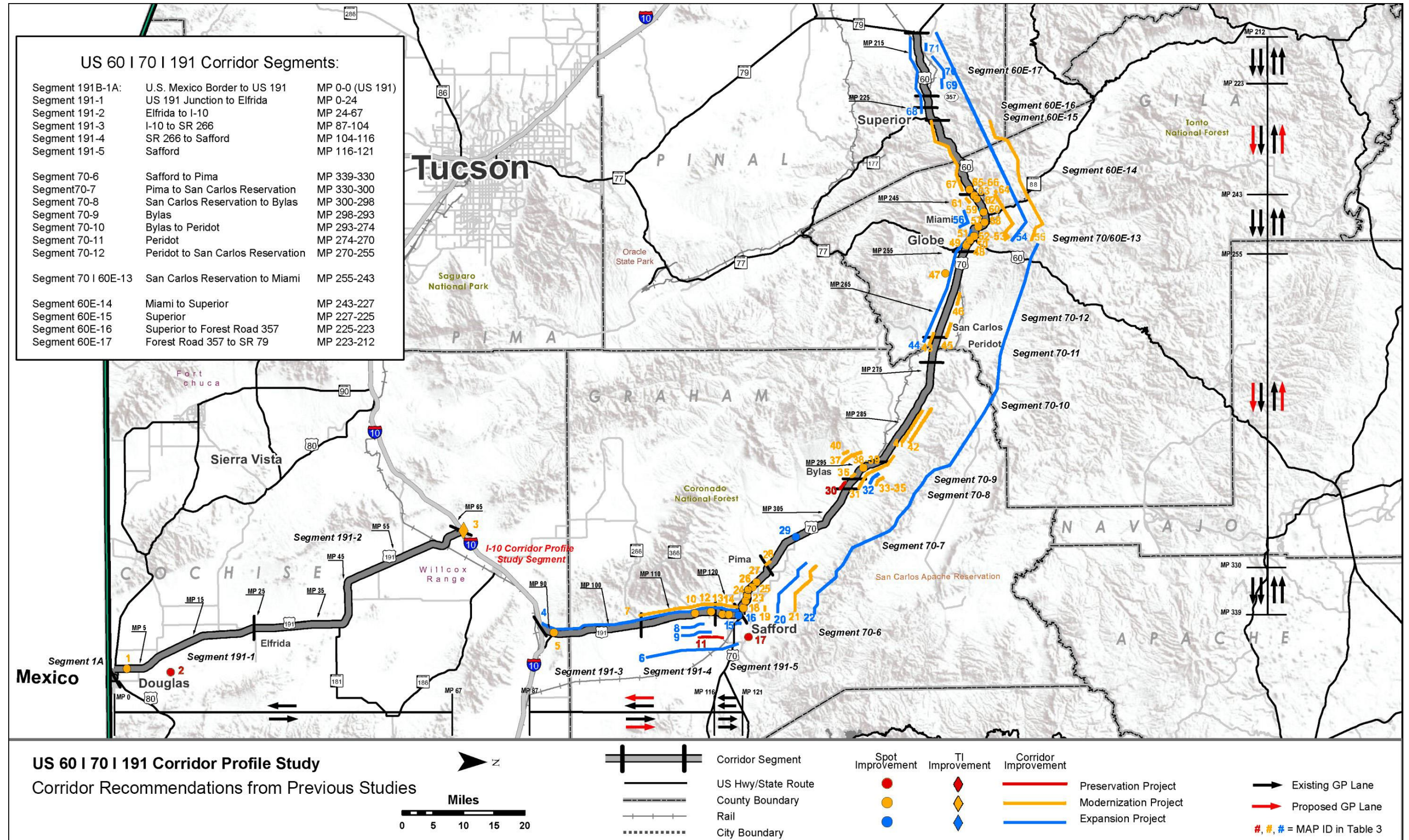
**Table 3: Corridor Recommendations from Previous Studies (continued)**

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Document
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)	
51	253	253	0	DMS sign eastbound		√				N	Arizona Statewide DMS Plan
52	252	243	9	Speed Limit Study		√		2015		N	Cobre Valley Comprehensive Transportation Study
53	252	243	9	Construct new sidewalks on north side		√		2020		N	Cobre Valley Comprehensive Transportation Study
54	252	212	40	Construct alternative alignment/Widen to 4 lanes			√	2030		N	Cobre Valley Comprehensive Transportation Study /BQAZ
55	252	227	25	Priority Paved Shoulder Opportunity		√				N	ADOT Statewide Bicycle and Pedestrian Plan Update
56	251	246	5	Passenger rail service along Arizona Eastern Railway from Miami to Globe			√			N	Gila County Rail Passenger Study
57	250.75	250.75	0	Replace Maple Street Bridge		√		2020		N	Cobre Valley Comprehensive Transportation Study
58	249.9	249.9	0	Rehabilitate Pinal Creek bridge		√		2020		N	Cobre Valley Comprehensive Transportation Study
59	247	246.5	0.5	Access Management Study		√		2015		N	Cobre Valley Comprehensive Transportation Study
60	247	247	0	DMS Sign Eastbound		√				N	Arizona Statewide DMS Plan
61	245.5	243	2.5	Implement access management through Miami		√		2030		N	Cobre Valley Comprehensive Transportation Study
62	244.6	244.6	0	Intersection improvements at Latham Boulevard		√		2020		N	Cobre Valley Comprehensive Transportation Study
63	244.5	244.5	0	Add exclusive turn lanes on US 60		√		2020		N	Cobre Valley Comprehensive Transportation Study
64	244.25	244	0.25	Restripe to a five-lane section		√		2020		N	Cobre Valley Comprehensive Transportation Study
65	243.75	243.75	0	Rehabilitate Bloody Tanks Wash bridge		√		2020		N	Cobre Valley Comprehensive Transportation Study
66	242	242	0	Re-align intersection		√		2030		N	Cobre Valley Comprehensive Transportation Study
67	242	227	15	East and Westbound Shoulder Improvement		√				N	Statewide Shoulders Study

**Table 3: Corridor Recommendations from Previous Studies (continued)**

Map Key Ref. #	Begin MP	End MP	Length (miles)	Project Description	Investment Category (Preservation [P], Modernization[M], Expansion [E])			Status of Recommendation			Document
					P	M	E	Program Year	Project No.	Environmental Documentation (Y/N)	
68	226	213	13	Regional part-time bus service between Florence Junction and Superior; park-and-ride in the vicinity of Florence Junction			√			N	Pinal County Transit Feasibility Study
69	222.3	219.9	2.4	Picket Post- Construct new EB lanes parallel to existing, between Reymert Wash and Queen Creek			√			Y	US 60 Florence Jct – Superior DCR and EA
70	219.9	216.3	3.6	Gonzales Pass- Construct new EB lanes west of the summit, construct new WB lanes east of the summit			√			Y	US 60 Florence Jct – Superior DCR and EA
71	215	214	1	Queen Valley TI- Construct full access controlled, grade-separated interchange over Queen Valley Rd and the Arizona Magma RR			√			Y	US 60 Florence Jct – Superior DCR and EA
-	N/A	N/A	0	Bridge Infrastructure Improvements East of SR 177	√					N	Arizona Key Commerce Corridor
-	N/A	N/A	0	Bridge Infrastructure Improvements between SR 177 and SR 77	√					N	Arizona Key Commerce Corridor
-	N/A	N/A	0	Bridge Infrastructure Improvements at Globe	√					N	Arizona Key Commerce Corridor

Figure 4: Corridor Recommendations from Previous Studies



## 2.0 CORRIDOR PERFORMANCE

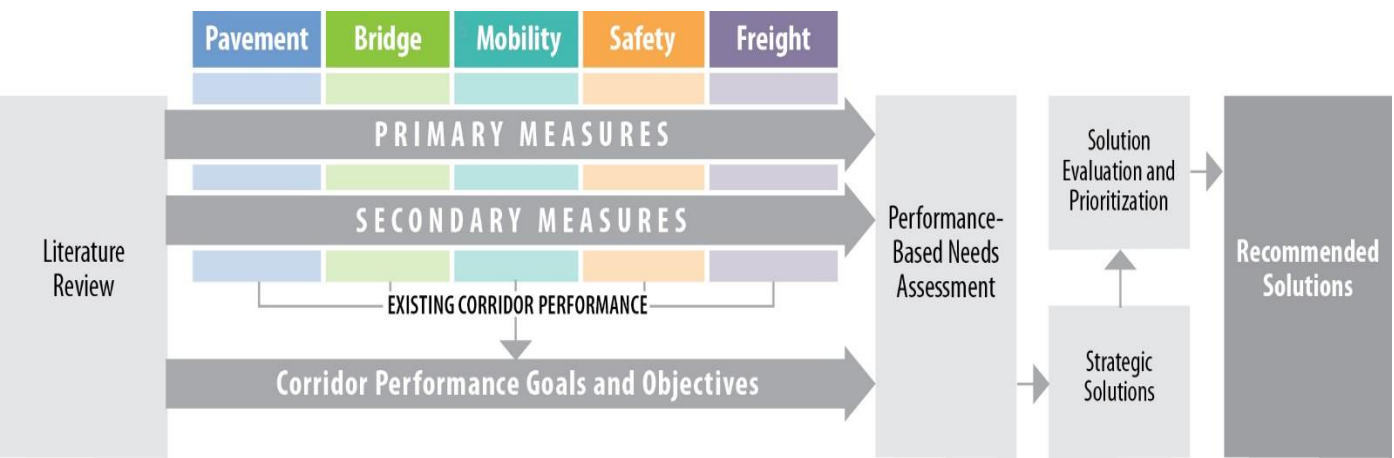
This chapter describes the evaluation of the existing performance of the US 60|US 70|US 191 corridor. A series of performance measures are used to assess the corridor. The results of the performance evaluation are used to define corridor needs relative to the long-term goals and objectives for the corridor.

### 2.1 Corridor Performance Framework

This study uses a performance-based process to define baseline corridor performance, diagnose corridor needs, develop corridor solutions, and prioritize strategic corridor investments. In support of this objective, a framework for the performance-based process was developed through a collaborative process involving ADOT and the CPS consultant teams.

**Figure 5** illustrates the performance framework, which includes a two-tiered system of performance measures (primary and secondary) to evaluate baseline performance. The primary measures in each of five performance areas are used to define the overall health of the corridor, while the secondary measures identify locations that warrant further diagnostic investigation to delineate needs. Needs are defined as the difference between baseline corridor performance and established performance objectives.

**Figure 5: Corridor Profile Performance Framework**



The following five performance areas guide the performance-based corridor analyses:

- Pavement
- Bridge
- Mobility
- Safety
- Freight

These performance areas reflect national performance goals stated in Moving Ahead for Progress in the 21<sup>st</sup> Century (MAP-21):

- Safety: To achieve a significant reduction in traffic fatalities and serious injuries on all public roads
- Infrastructure Condition: To maintain the highway infrastructure asset system in a state of good repair
- Congestion Reduction: To achieve a significant reduction in congestion on the National Highway System
- System Reliability: To improve the efficiency of the surface transportation system
- Freight Movement and Economic Vitality: To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development
- Environmental Sustainability: To enhance the performance of the transportation system while protecting and enhancing the natural environment
- Reduced Project Delivery Delays: To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion

The MAP-21 performance goals were considered in the development of ADOT's P2P process, which integrates transportation planning with capital improvement programming and project delivery. Since the P2P program requires the preparation of annual transportation system performance reports using the five performance areas adopted for the CPS, consistency is achieved in the performance measures used for various ADOT analysis processes.

The performance measures include five primary measures: Pavement Index, Bridge Index, Mobility Index, Safety Index, and Freight Index. Additionally, a set of secondary performance measures provides for a more detailed analysis of corridor performance.

Each of the primary and secondary performance measures is comprised of one or more quantifiable indicators. A three-level scale was developed to standardize the performance scale across the five performance areas, with numerical thresholds specific to each performance measure:

Good/Above Average Performance	Rating is above the identified desirable/average range
Fair/Average Performance	Rating is within the identified desirable/average range
Poor/Below Average Performance	Rating is below the identified desirable/average range

**Table 4** provides the complete list of primary and secondary performance measures for each of the five performance areas.

**Table 4: Corridor Performance Measures**

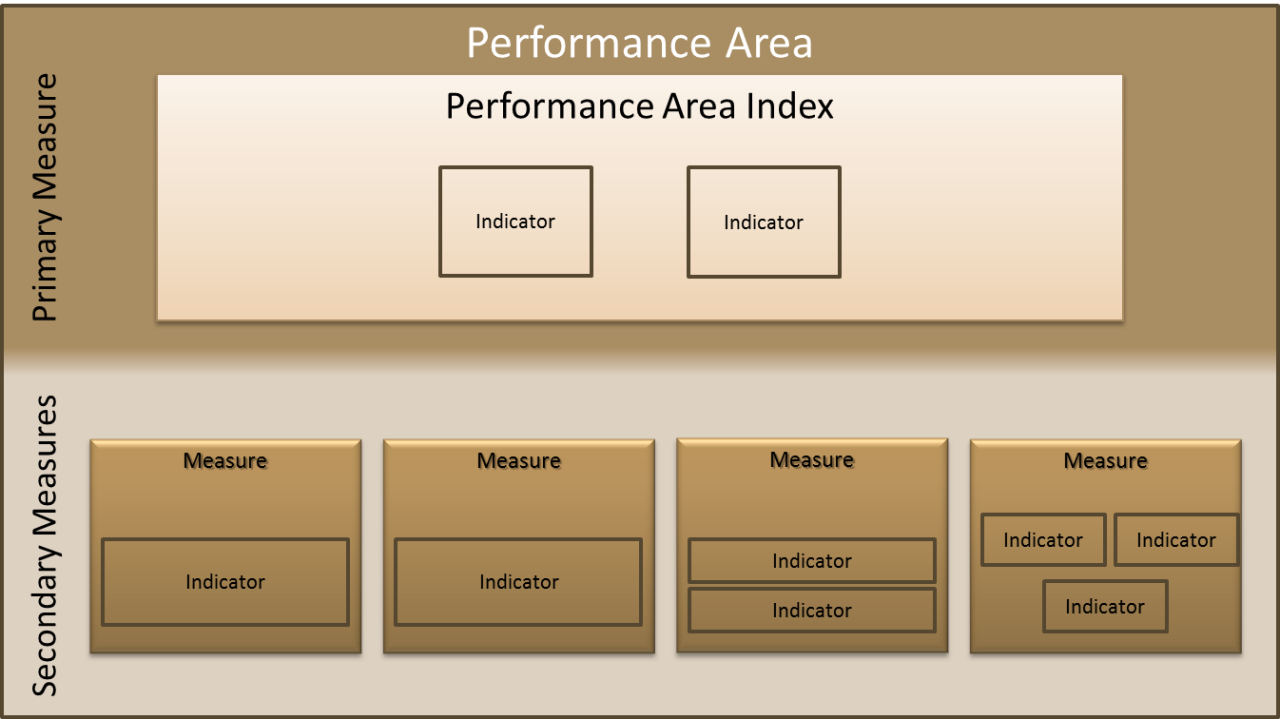
Performance Area	Primary Measure	Secondary Measures
<b>Pavement</b>	<b>Pavement Index</b> Based on a combination of International Roughness Index and cracking	<ul style="list-style-type: none"> <li>Directional Pavement Serviceability</li> <li>Pavement Failure</li> <li>Pavement Hot Spots</li> </ul>
<b>Bridge</b>	<b>Bridge Index</b> Based on lowest of deck, substructure, superstructure and structural evaluation rating	<ul style="list-style-type: none"> <li>Bridge Sufficiency</li> <li>Functionally Obsolete Bridges</li> <li>Bridge Rating</li> <li>Bridge Hot Spots</li> </ul>
<b>Mobility</b>	<b>Mobility Index</b> Based on combination of existing and future daily volume-to-capacity ratios	<ul style="list-style-type: none"> <li>Future Congestion</li> <li>Peak Congestion</li> <li>Travel Time Reliability</li> <li>Multimodal Opportunities</li> </ul>
<b>Safety</b>	<b>Safety Index</b> Based on frequency of fatal and incapacitating injury crashes	<ul style="list-style-type: none"> <li>Directional Safety Index</li> <li>Strategic Highway Safety Plan Emphasis Areas</li> <li>Crash Unit Types</li> <li>Safety Hot Spots</li> </ul>
<b>Freight</b>	<b>Freight Index</b> Based on bi-directional truck planning time index	<ul style="list-style-type: none"> <li>Recurring Delay</li> <li>Non-Recurring Delay</li> <li>Closure Duration</li> <li>Bridge Vertical Clearance</li> <li>Bridge Vertical Clearance Hot Spots</li> </ul>

The general template for each performance area is illustrated in **Figure 6**.

The guidelines for performance measure development are:

- Indicators and performance measures for each performance area should be developed for relatively homogeneous corridor segments
- Performance measures for each performance area should be tiered, consisting of primary measure(s) and secondary measure(s)
- Primary and secondary measures should assist in identifying those corridor segments that warrant in-depth diagnostic analyses to identify performance-based needs and a range of corrective actions known as solution sets
- One or more primary performance measures should be used to develop a Performance Index to communicate the overall health of a corridor and its segments for each performance area; the Performance Index should be a single numerical index that is quantifiable, repeatable, scalable, and capable of being mapped; primary performance measures should be transformed into a Performance Index using mathematical or statistical methods to combine one or more data fields from an available ADOT database
- One or more secondary performance measure indicators should be used to provide additional details to define corridor locations that warrant further diagnostic analysis; secondary performance measures may include the individual indicators used to calculate the Performance Index and/or “hot spot” features

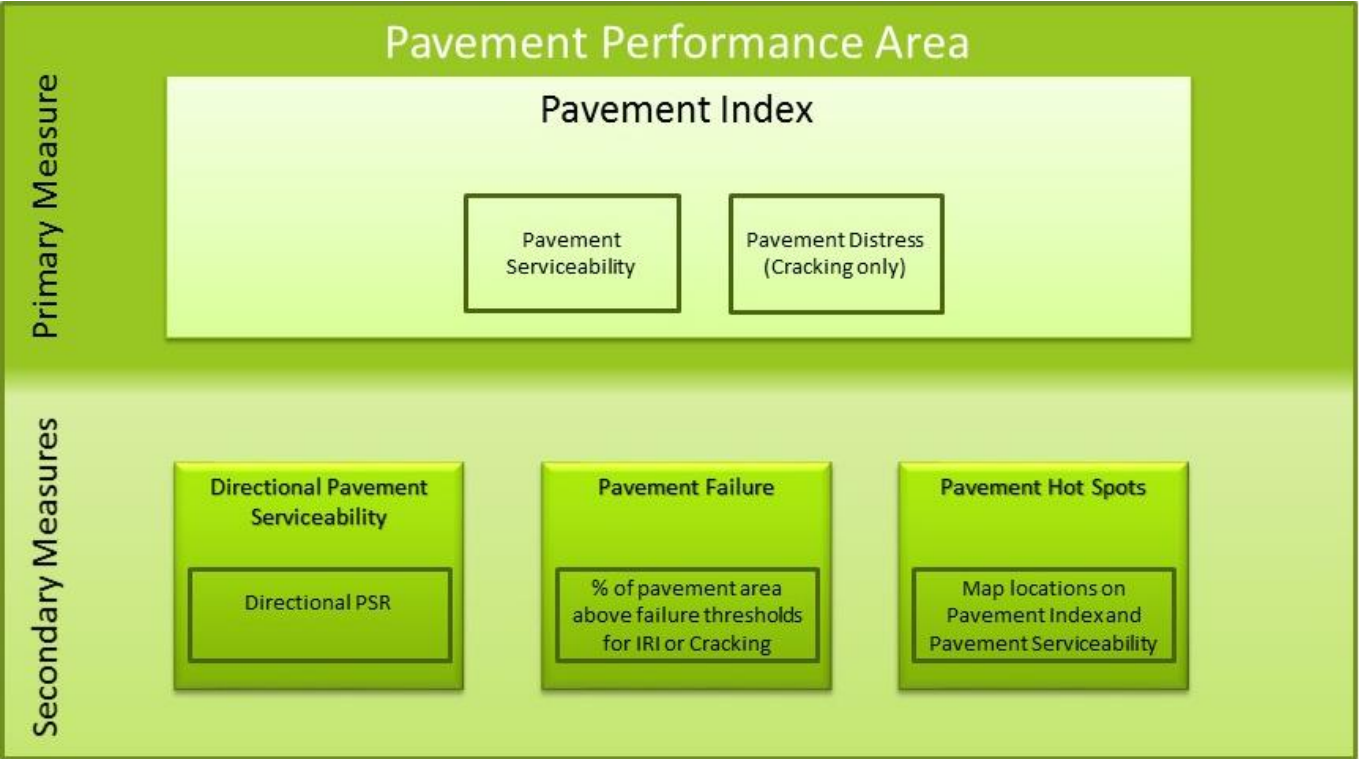
**Figure 6: Performance Area Template**



## 2.2 Pavement Performance Area

The Pavement performance area consisted of a primary measure (Pavement Index) and three secondary measures, as shown in **Figure 7**. These measures assess the condition of the existing pavement along the US 60|US 70|US 191 corridor. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

**Figure 7: Pavement Performance Measures**



### Primary Pavement Index

The Pavement Index is calculated using two pavement condition ratings: the Pavement Serviceability Rating (PSR) and the Pavement Distress Index (PDI).

The PSR is extracted from the International Roughness Index (IRI), a measurement of pavement roughness based on field-measured longitudinal roadway profiles. The PDI is extracted from the Cracking Rating (CR), a field-measured sample from each mile of highway.

Both the PSR and PDI use a 0 to 5 scale with 0 representing the lowest performance and 5 representing the highest. The Pavement Index for each segment is a weighted average of the directional ratings based on the number of travel lanes. Therefore, the condition of a section with

more travel lanes will have a greater influence on the resulting segment Pavement Index than the condition of a section with fewer travel lanes.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Pavement performance area, the relevant operating environments are designated as interstate and non-interstate segments. For US 60|US 70|US 191, all segments are considered the non-interstate operating environment.

### Secondary Pavement Measures

Three secondary measures provide an in-depth evaluation of the different characteristics of pavement performance.

#### *Directional Pavement Serviceability*

- Weighted average (based on number of lanes) of the PSR for the pavement in each direction of travel

#### *Pavement Failure*

- Percentage of pavement area rated above failure thresholds for IRI or Cracking

#### *Pavement Hot Spots*

- A Pavement “hot spot” exists where a given one-mile section of roadway rates as being in “poor” condition
- Highlights problem areas that may be under-represented in a segment average. This measure is recorded and mapped, but not included in the Pavement performance area rating calculations

### Pavement Performance Results

The Pavement Performance Index provides a high-level assessment of the pavement condition for the corridor and for each segment. The three secondary measures provide more detailed information to assess pavement performance.

Based on the results of the analysis, the following pavement conditions were observed on US 60|US 70|US 191:

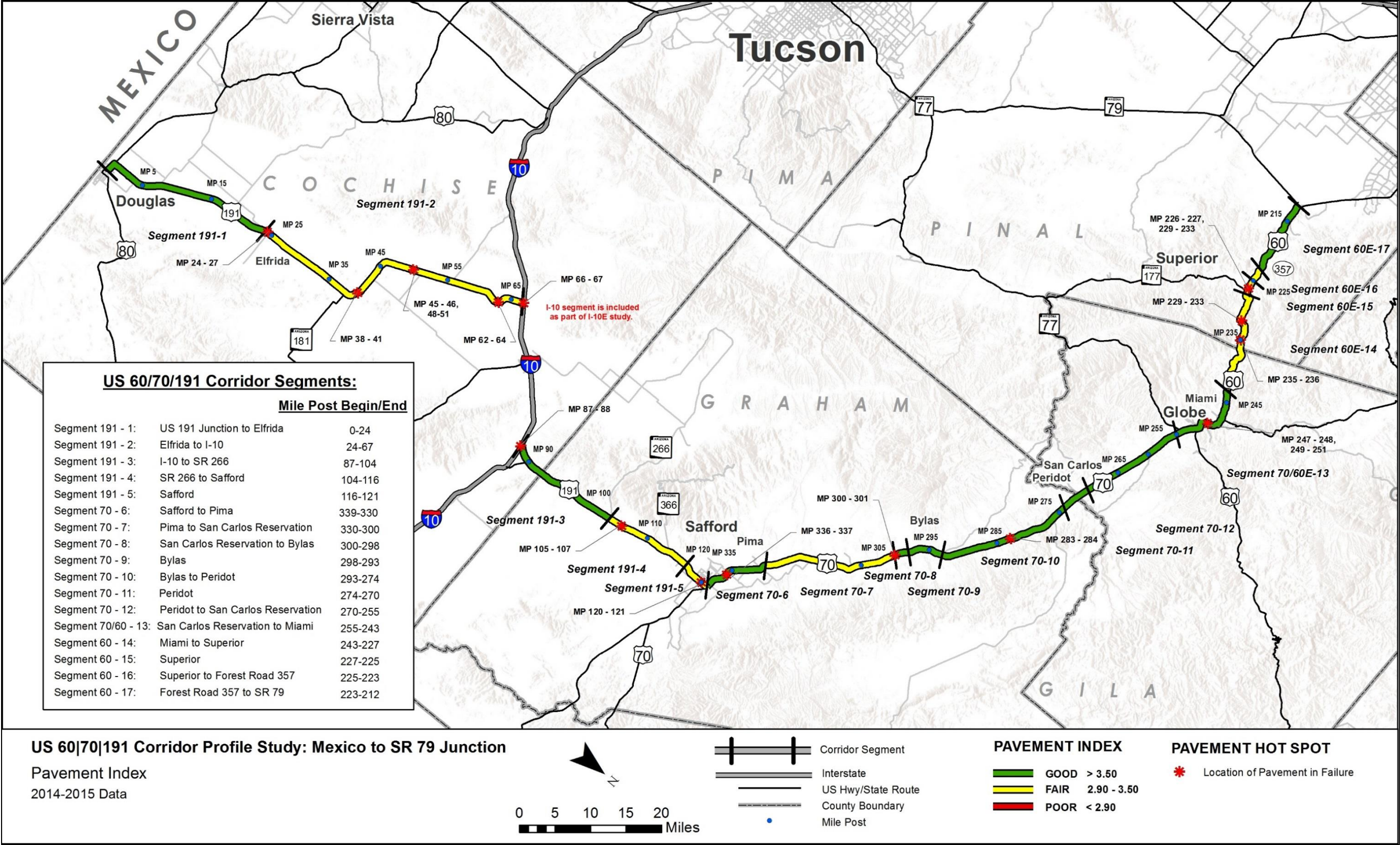
- Based on the weighted average of the Pavement Index, the pavement is in “good” condition on 10 of the 17 segments studied and “fair” condition for the remaining 7 segments.
- Segments 191-2, 60-14 and 60-15 included several miles of failure hot spots, including 13 miles on US 191 between MP 24 and MP 67. Both excessive pavement roughness and cracking were evenly identified in Segment 191-2. In Segments 60-14 and 60-15, the primary cause for pavement failure was related to excessive roughness.
- Pavement Failure evaluation assesses the percentage of lane miles considered in failure throughout the corridor. Three segments exceed the 20% worse than average performance threshold. These include Segment 191-2 (30%), Segment 60-14 (31%), and Segment 60-15 (50%). It is important to note that Segment 60-15 in Superior is only 2 miles in length. Between MP 226 and MP 227 showed excessive roughness.
- Segment 191-2 yielded the lowest Pavement Index and the lowest PDI (cracking) scores.

**Table 5** summarizes the Pavement performance results for the US 60|US 70|US 191 corridor. **Figure 8** illustrates the primary Pavement Index performance and locations of pavement hot spots along the US 60|US 70|US 191 corridor. Maps for each secondary measure can be found in **Appendix A**.

Table 5: Pavement Performance

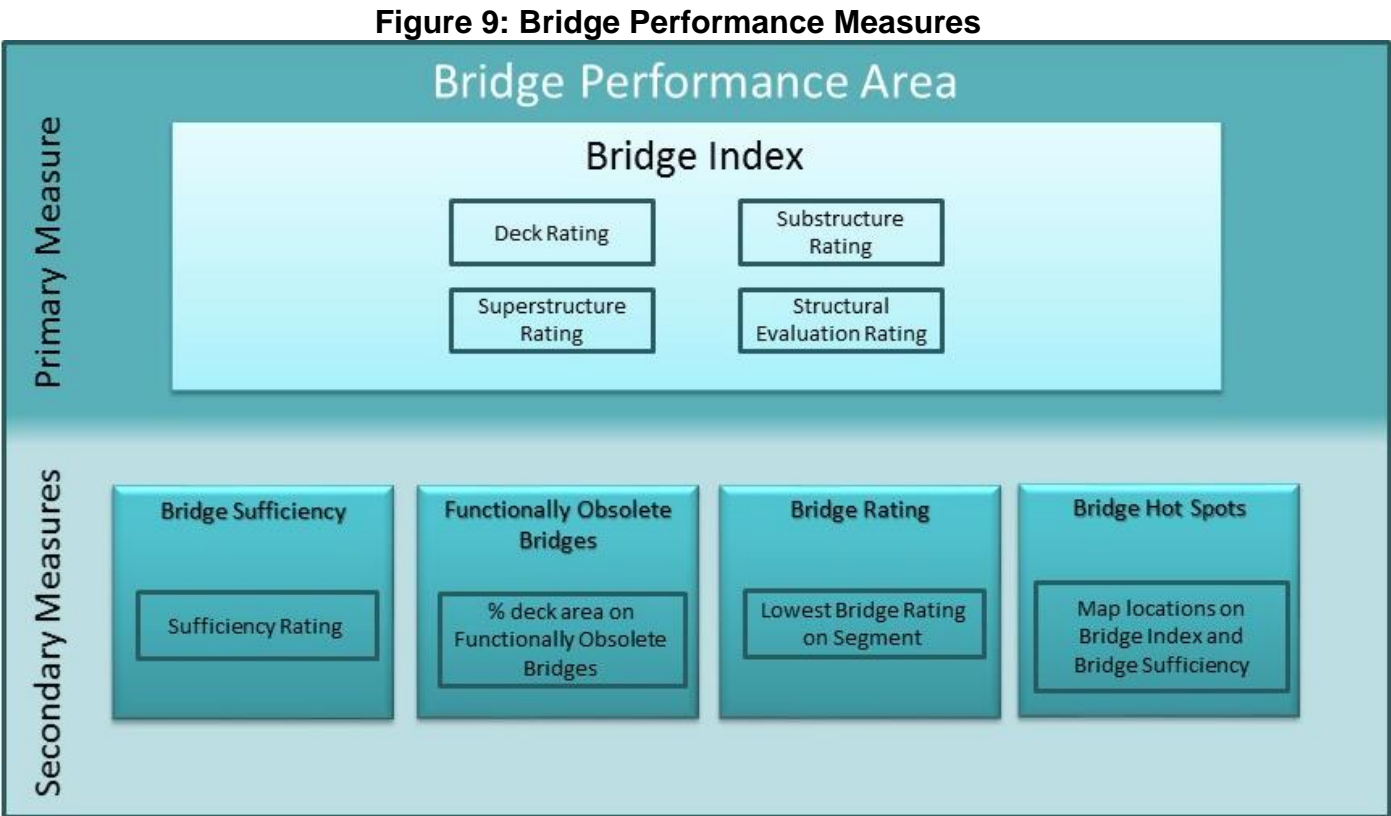
Segment #	Segment Length (miles)	Pavement Index	Directional PSR		% Area Failure
			NB/WB	SB/EB	
191 - 1	24	3.64	3.37	3.37	0%
191 - 2	43	3.06	3.31	3.31	30%
191 - 3	17	3.93	4.02	3.94	3%
191 - 4	12	3.28	3.28	3.28	17%
191 - 5	5	3.28	3.28	3.28	20%
70 - 6	9	3.70	3.44	3.44	10%
70 - 7	19	3.43	3.35	3.35	5%
70 - 8	2	3.87	3.78	3.78	0%
70 - 9	5	3.81	3.80	3.80	0%
70 - 10	19	3.87	3.55	3.55	5%
70 - 11	4	3.88	3.55	3.55	0%
70 - 12	15	3.97	3.83	3.83	0%
70 60 - 13	12	3.65	3.43	3.34	19%
60 - 14	16	3.43	3.24	3.24	31%
60 - 15	2	3.21	2.92	2.92	50%
60 - 16	2	3.32	3.38	3.38	0%
60 - 17	11	4.30	4.14	4.02	0%
Weighted Corridor Average		3.57	3.49	3.49	13%
SCALE					
Performance Level		Non-Interstate			
Good/ Above Average Performance		> 3.50		< 5%	
Fair/ Average Performance		2.9 - 3.5		5%-20%	
Poor/ Average Performance		< 2.90		> 20%	

Figure 8: Pavement Performance



### 2.3 Bridge Performance Area

The Bridge performance area consists of a primary measure (Bridge Index) and four secondary measures, as shown in **Figure 9**. These measures assess the condition of the existing bridges along the US 60|US 70|US 191 corridor. Only bridges that carry mainline traffic or bridges that cross the mainline are included in the calculation. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.



#### Primary Bridge Index

The Bridge Index is calculated based on the use of four different bridge condition ratings from the ADOT Bridge Database, also known as the Arizona Bridge Information and Storage System (ABISS). The four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating. These ratings are based on inspection reports and establish the structural adequacy of each bridge. The performance of each individual bridge is established by using the lowest of these four ratings. The use of these ratings, and the use of the lowest rating, is consistent with the approach used by the ADOT Bridge Group to assess the need for bridge rehabilitation. The Bridge Index is calculated as a weighted average for each segment based on deck area.

#### Secondary Bridge Measures

Four secondary measures provide an in-depth evaluation of the characteristics of each bridge:

##### *Bridge Sufficiency*

- Multipart rating includes structural adequacy and safety factors as well as functional aspects such as traffic volume and length of detour
- Rates the structural and functional sufficiency of each bridge on a 100-point scale

##### *Functionally Obsolete Bridges*

- Percentage of total deck area in a segment that is on functionally obsolete bridges
- Identifies bridges that no longer meet standards for current traffic volumes, lane width, shoulder width, or bridge rails
- A bridge that is functionally obsolete may still be structurally sound

##### *Bridge Rating*

- The lowest rating of the four bridge condition ratings (substructure, superstructure, deck, and structural evaluation) on each segment
- Identifies lowest performing evaluation factor on each bridge

##### *Bridge Hot Spots*

- A Bridge “hot spot” is identified where a given bridge has a bridge rating of 4 or lower or multiple ratings of 5 between the deck, superstructure, and substructure ratings
- Identifies particularly low-performing bridges or those that may decline to low performance in the immediate future

### Bridge Performance Results

The Bridge Index provides a top-level assessment of the structural condition of bridges on the US 60|US 70|US 191 corridor, and for each corridor segment. The three secondary measures provide more detailed information to assess the bridge condition for each segment. A total of 48 major structures classified as bridges were included in the analysis. Major structures that are classified as Reinforced Concrete Box Culverts (RCBC) were not considered. Overall, based on the Bridge Index, all segments show “fair” performance.

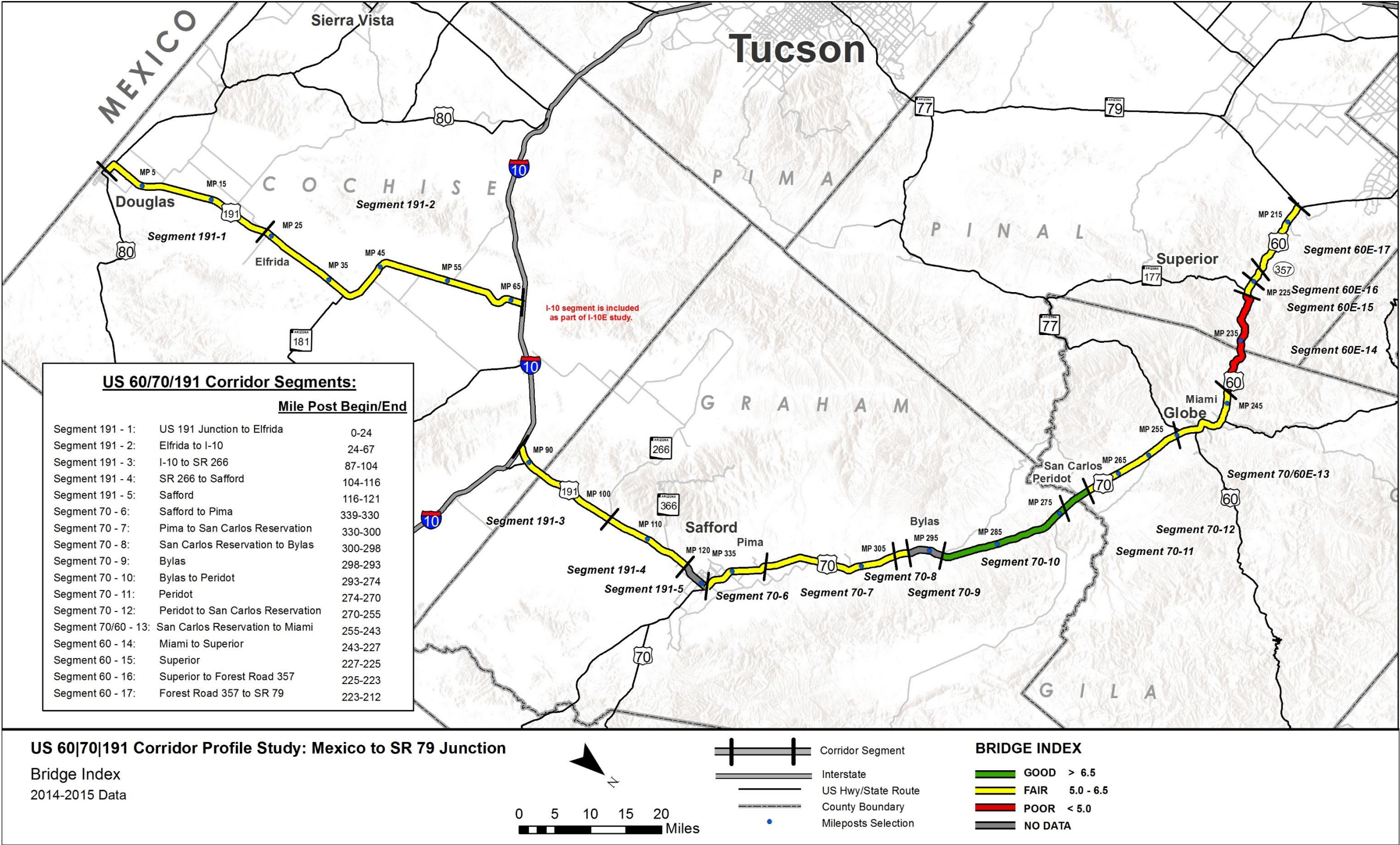
- The majority of segments fall within the “Fair” performance rating for the Bridge Index, which consists of the deck, substructure, superstructure and structural ratings. The ratings ranged from 4.56 to 7.54 out of 9.
- Segment 60-14 has the poorest Bridge Index at a 4.56 rating. This is due to three bridges within the segment being structurally deficient (see fourth bullet) and a tunnel with a deck rating of 5.
- Bridge Sufficiency ratings per segment range from “Good” to “Poor”. The weighted averaged values range from 36.03 to 93.91 out of 100.
- Four bridges have been rated as structurally deficient, all of which are on US 60. At MP 227.71, the Queen Creek Bridge (No. 406) has deck, substructure, superstructure and structural evaluation ratings of 4. The Waterfall Canyon Bridge (MP 229.50, No. 328) has superstructure and structural evaluation ratings of 4. The poorest rated bridge is the Pinto Creek Bridge (No. 351) at MP 238.25, which has deck, substructure, superstructure and structural evaluation ratings of 4. At MP 249.64, the Pinal Creek Bridge (No. 266) has deck, substructure and structural evaluation ratings of 4.
- Two of the 17 analysis segments on the corridor exceed the threshold for “Poor” performance as Functionally Obsolete Bridges by current ADOT design standards. These include Segments 70|60-13 (49% bridge area comprised of the Globe Viaduct) and 60-15 (57% bridge area comprised of the Stone Avenue Overpass and Route 177 TI Underpass).
- Three bridges have multiple ratings of 5 for the deck, substructure, superstructure and structural evaluation.
- Queen Creek Tunnel (MP 228.47, No. 407) located on US 60 approximately 1.6 miles east of the SR 177 junction is a major feature on the corridor that was not evaluated within the performance framework for structural integrity (it is considered in freight performance for the vertical clearance secondary measure). This unique feature (located within Segment 60-14) will require isolated consideration throughout the Corridor Profile Study process to include its contribution to corridor condition and needs. According to the NBI data provided by the ADOT Bridge Group, the deck condition (N59) has a rating of 5. With this 5 (fair) rating, the tunnel will be considered a hot spot under bridge performance.

**Table 6** summarizes the bridge performance results for the US 60|US 70|US 191 corridor. **Figure 10** illustrates the primary bridge index performance and locations of bridge hot spots along US 60|US 70|US 191. Maps for each secondary measure can be found in **Appendix A**.

**Table 6: Bridge Performance**

Segment #	Segment Length (miles)	# of Bridges	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating
191 - 1	24	1	6.00	89.00	0%	6
191 - 2	43	2	5.37	76.93	0%	5
191 - 3	17	2	6.02	93.91	0%	5
191 - 4	12	1	6.00	69.50	0%	6
191 - 5	5	0	No Bridges			
70 - 6	9	1	6.00	69.10	0%	6
70 - 7	19	8	5.77	71.59	0%	5
70 - 8	2	1	6.00	74.00	0%	6
70 - 9	5	0	No Bridges			
70 - 10	19	1	7.00	80.00	0%	7
70 - 11	4	2	7.54	82.03	0%	5
70 - 12	15	1	6.00	63.20	0%	6
70 60 - 13	12	11	5.17	78.89	49%	4
60 - 14	16	5	4.56	36.03	0%	4
60 - 15	2	3	6.00	83.70	57%	6
60 - 16	2	2	5.00	86.66	0%	5
60 - 17	11	7	6.42	91.11	0%	5
Weighted Corridor Average			5.56	72.20	3%	5
SCALE						
Performance Level		All				
Good			> 6.5	> 80	< 12%	> 6
Fair			5.0 - 6.5	50 - 80	12%-40%	5 - 6
Poor			< 5.0	< 50	> 40%	< 5

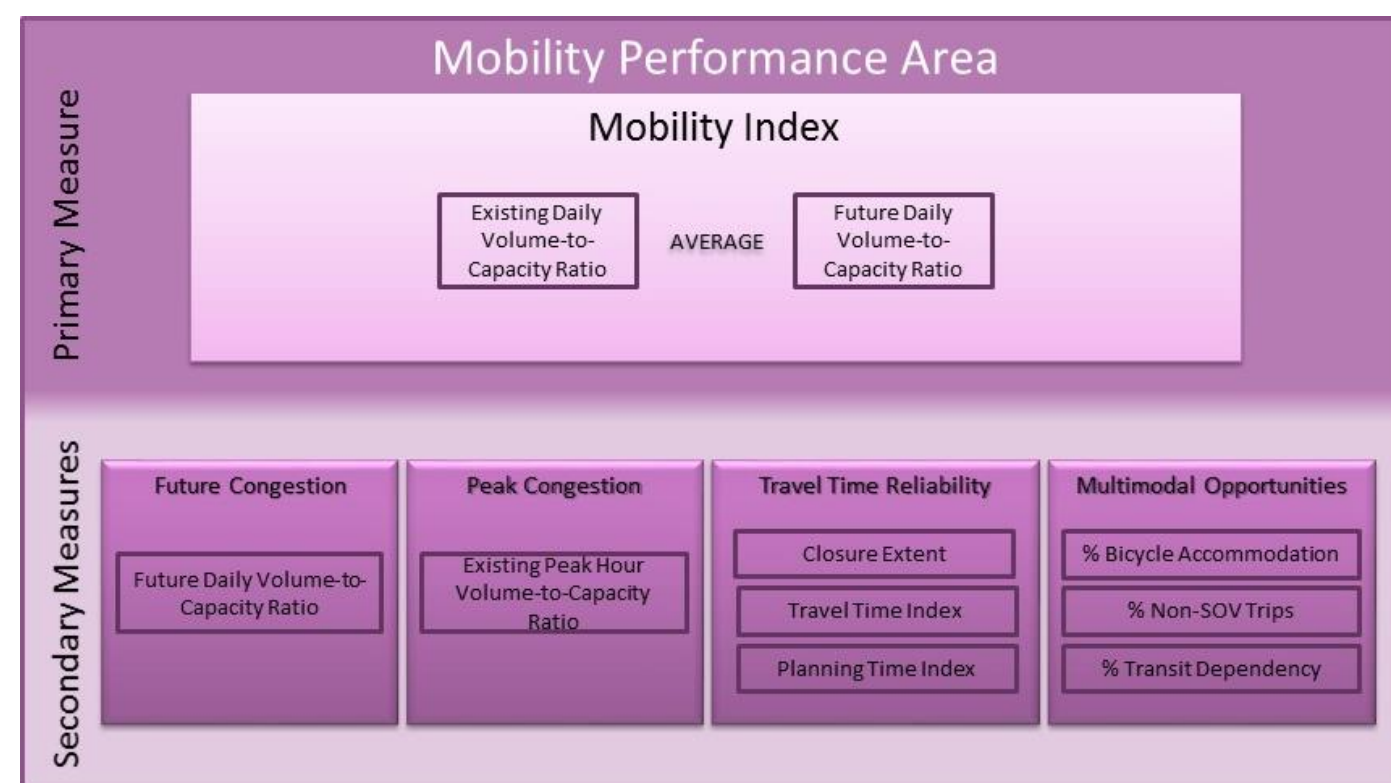
Figure 10: Bridge Performance



## 2.4 Mobility Performance Area

The Mobility performance area consists of a primary measure (Mobility Index) and four secondary measures, as shown in **Figure 11**. These measures assess the condition of existing mobility along the US 60|US 70|US 191 corridor. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

**Figure 11: Mobility Performance Measures**



### Primary Mobility Index

The Mobility Index is an average of the existing (2014) daily volume-to-capacity (V/C) ratio and the future (2035 AZTDM) daily V/C ratio for each segment of the corridor. The V/C ratio is an indicator of the level of congestion. This measure compares the average annual daily traffic (AADT) volume to the capacity of the corridor segment as defined by the service volume for level of service (LOS) E. By using the average of the existing and future year daily volumes, this index measures the level of daily congestion projected to occur in approximately ten years (2025) if no capacity improvements are made to the corridor.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Mobility performance area, the relevant operating environments are urban vs. rural setting and interrupted flow (e.g., signalized at-grade intersections are present) vs. uninterrupted

flow (e.g., controlled access grade-separated conditions such as a freeway or interstate highway). For US 60|US 70|US 191, the following operating environments were identified:

- Urban Interrupted (Segments 5-6; 13)
- Rural Uninterrupted (Segments 3-4; 7-12; 14-17)
- Rural Interrupted (Segments 1-2)

### Secondary Mobility Measures

Four secondary measures provide an in-depth evaluation of operational characteristics of the corridor:

#### *Future Congestion – Future Daily V/C*

- The future (2035 AZTDM) daily V/C ratio. This measure is the same value used in the calculation of the Mobility Index
- Provides a measure of future congestion if no capacity improvements are made to the corridor

#### *Peak Congestion – Existing Peak Hour V/C*

- The peak hour V/C ratio for each direction of travel
- Provides a measure of existing peak hour congestion during typical weekdays

*Travel Time Reliability*– Three separate travel time reliability indicators together provide a comprehensive picture of how much time may be required to travel within the corridor:

- Closure Extent:
  - The average number of instances a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel; a weighted average was applied to each closure that takes into account the distance over which the closure occurs
  - Closures related to crashes, weather, or other incidents are a significant contributor to non-recurring delays; construction-related closures were excluded from the analysis
- Directional Travel Time Index (TTI):
  - The ratio of the average peak period travel time to the free-flow travel time (based on the posted speed limit) in a given direction
  - The TTI recognizes the delay potential from recurring congestion during peak periods; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics

- Directional Planning Time Index (PTI):
  - The ratio of the 95<sup>th</sup> percentile travel time to the free-flow travel time (based on the posted speed limit) in a given direction
  - The PTI recognizes the delay potential from non-recurring delays such as traffic crashes, weather, or other incidents; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
  - The PTI indicates the amount of time in addition to the typical travel time that should be allocated to make an on-time trip 95% of the time in a given direction

*Multimodal Opportunities* – Three multimodal opportunity indicators reflect the characteristics of the corridor that promote alternate modes to the single occupancy vehicle (SOV) for trips along the corridor:

- % Bicycle Accommodation:
  - Percentage of the segment that accommodates bicycle travel; bicycle accommodation on the roadway or on shoulders varies depending on traffic volumes, speed limits, and surface type
  - Encouraging bicycle travel has the potential to reduce automobile travel, especially on non-interstate highways
- % Non-SOV Trips:
  - The percentage of trips (less than 50 miles in length) by non-SOVs
  - The percentage of non-SOV trips in a corridor gives an indication of travel patterns along a section of roadway that could benefit from additional multimodal options
- % Transit Dependency:
  - The percentage of households that have zero or one automobile and households where the total income level is below the federally defined poverty level
  - Used to track the level of need among those who are considered transit dependent and more likely to utilize transit if it is available

#### Mobility Performance Results

The Mobility Index provides a high-level assessment of mobility conditions for the corridor and for each segment. The four secondary measures provide more detailed information to assess mobility performance.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the mobility performance area, the relevant operating environments included urban or rural locations, as well as interrupted flow (where signalized at-grade intersections are present) and uninterrupted flow (grade-separated).

Based on the results of this analysis, the following observations were made:

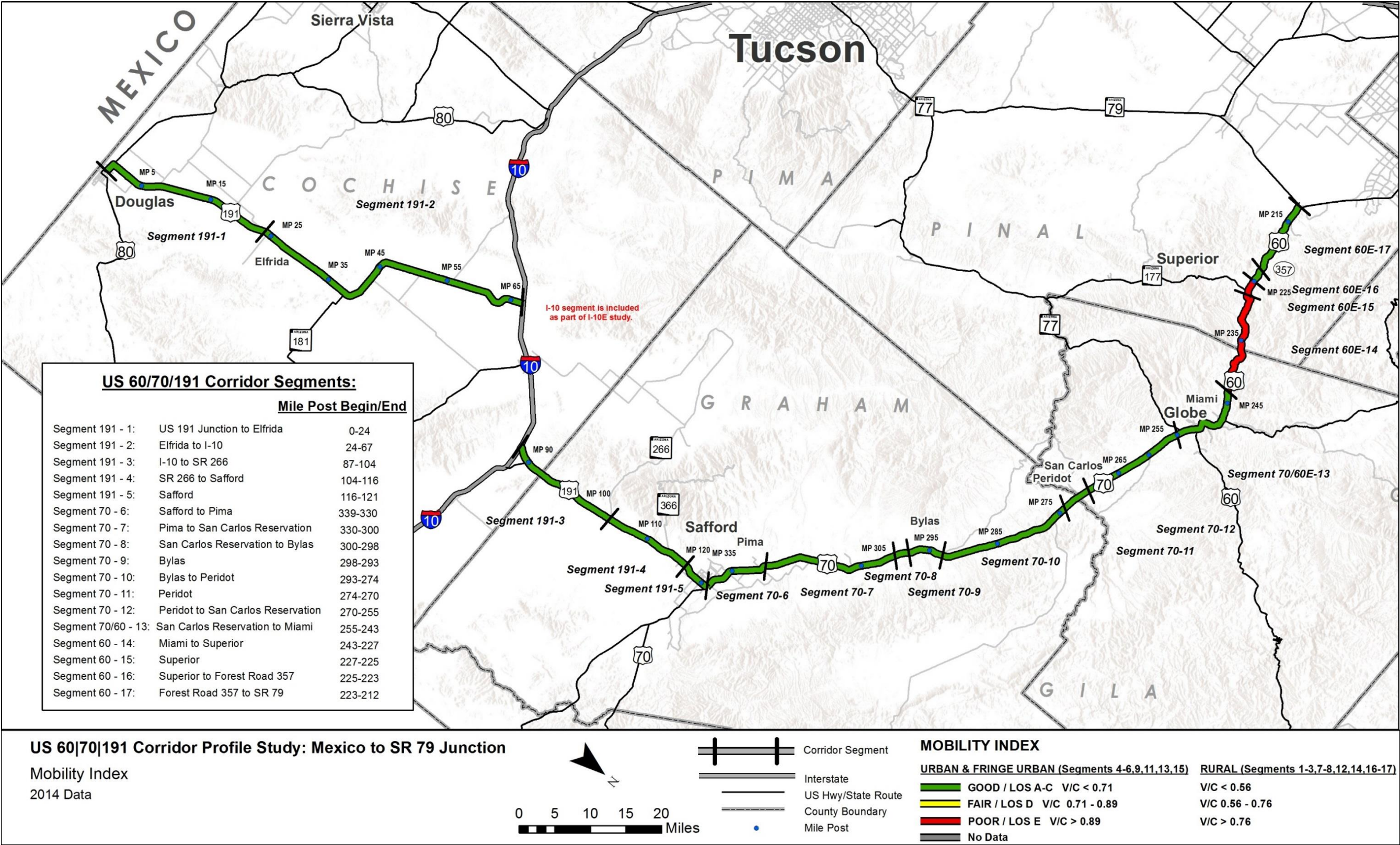
- Overall, based on the weighted average of the Mobility Index, the traffic operations are in “good” condition. Segment 60-14 and 60-15 rated “poor” due to high V/C ratios caused by the mountainous grade, which decreases the overall throughput.
- Existing peak hour traffic operations are “good” throughout the corridor, except for Segment 60-14 and 60-15 which is rated as “poor”.
- Future traffic operations are anticipated to be “good” throughout the corridor, with the exception being “poor” in Segment 60-14 and 60-15 and “fair” in 60-16.
- Most of the corridor performed “good” in measuring closures for travel time reliability. Segments 60-14, 60-15 and 60-16 showed “fair” performance in the westbound direction, Segment 70-12 showed “fair” performance in the eastbound direction, and Segments 60-14 and 60-15 showed “poor” performance in the eastbound direction, with Segment 60-14 having the highest number of closures.
- TTI measures generally show “good” along the corridor, with the exceptions of “poor” performance in the northbound direction of Segment 191-3, and “fair” performance in northbound Segment 191-1, southbound Segment 191-3, and eastbound segments 70|60-13, 60-14, and 60-15. However, 9 northbound/westbound segments and 8 southbound/eastbound segments are lacking permanent traffic counters and could not be analyzed.
- PTI measures generally show “poor” along the corridor, with four northbound/westbound segments rating “poor” and two segments rating “fair”, and in the southbound/eastbound direction five segments rating “poor” and two rating “fair”. As with the TTI measurement, the PTI could not be analyzed in 9 northbound/westbound segments and 8 southbound/eastbound segments are lacking permanent traffic counters and could not be analyzed.
- A majority of the corridor shows “poor” or “fair” performance for non-SOV trips meaning that many vehicles carry only a single occupant.
- Socioeconomic characteristics along the corridor show the potential for transit dependency as measured by income and vehicle availability. Most of the corridor falls within the statewide average for these characteristics.
- Ten segments show a “poor” performance for accommodation of bicycles due to lack of sufficient shoulder width. Bicycle accommodation is “good” on Segments 191-2, 191-4, 60-15, and 60-17 and “fair” for Segments 191-1, 70-7 and 60-16.

**Table 7** summarizes the Mobility performance results for the US 60|US 70|US 191 corridor. **Figure 12** illustrates the primary Mobility Index performance along the US 60|US 70|US 191 corridor. Maps for each secondary measure can be found in Appendix A.

Table 7: Mobility Performance

Segment #	Segment Length (miles)	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent (instances/mile/year)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips
				NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB		
191 - 1	24	0.15	0.17	0.12	0.12	0.03	0.01	1.51	1.30	4.79	7.47	66%	12.5%
191 - 2	43	0.09	0.10	0.07	0.07	0.02	0.00	1.16	1.16	9.83	6.09	100%	16.0%
191 - 3	17	0.04	0.04	0.03	0.03	0.01	0.00	1.39	1.20	9.51	11.62	49%	9.8%
191 - 4	12	0.18	0.20	0.14	0.14	0.03	0.03	N/A	N/A	N/A	N/A	96%	9.3%
191 - 5	5	0.33	0.39	0.27	0.28	0.12	0.08	N/A	N/A	N/A	N/A	27%	22.5%
70 - 6	9	0.53	0.69	0.32	0.32	0.02	0.06	N/A	N/A	N/A	N/A	46%	19.0%
70 - 7	19	0.18	0.21	0.13	0.13	0.02	0.00	N/A	N/A	N/A	N/A	73%	16.8%
70 - 8	2	0.12	0.15	0.08	0.08	0.00	0.10	N/A	N/A	N/A	N/A	0%	13.8%
70 - 9	5	0.25	0.29	0.16	0.17	0.00	0.04	N/A	N/A	N/A	N/A	26%	12.2%
70 - 10	19	0.17	0.19	0.11	0.11	0.09	0.04	N/A	N/A	N/A	N/A	4%	8.9%
70 - 11	4	0.21	0.26	0.12	0.12	0.10	0.00	N/A	N/A	N/A	N/A	4%	13.7%
70 - 12	15	0.19	0.23	0.13	0.13	0.04	0.31	N/A	1.10	N/A	1.40	23%	12.1%
70 60 - 13	12	0.40	0.46	0.29	0.30	0.00	0.12	1.15	1.31	2.72	3.36	54%	17.0%
60 - 14	16	1.73	2.11	1.22	1.09	0.33	1.57	1.07	1.19	1.47	2.06	49%	15.0%
60 - 15	2	2.76	3.83	1.28	1.30	0.36	1.17	1.08	1.17	1.67	2.30	95%	13.0%
60 - 16	2	0.54	0.71	0.28	0.28	0.50	0.00	1.09	1.00	1.91	1.04	87%	9.0%
60 - 17	11	0.20	0.26	0.11	0.10	0.09	0.05	1.01	1.01	1.16	1.24	96%	10.0%
Weighted Corridor Average		0.32	0.39	0.22	0.21	0.06	0.17					61%	14.0%
SCALE													
Performance Level		Urban/Fringe: Segments 5-6; 13 Rural: Segments 1-4; 7-12; 14-17				All		Uninterrupted: Segments 3-4; 7-12; 14-17 Interrupted: Segments 1-2; 5-6; 13				All	
Good		≤ 0.71 ≤ 0.56				≤ 0.22		≤ 1.15 ≤ 1.3		≤ 1.3 ≤ 3.0		> 90%	
Fair		0.71 - 0.89 0.56 - 0.76				0.22 - 0.62		1.15 - 1.33 1.3 - 2.0		1.3 - 1.5 3.0 - 6.0		60% - 90%	
Poor		> 0.89 > 0.76				≥ 0.62		≥ 1.33 ≥ 2.0		≥ 1.5 ≥ 6.0		< 60%	

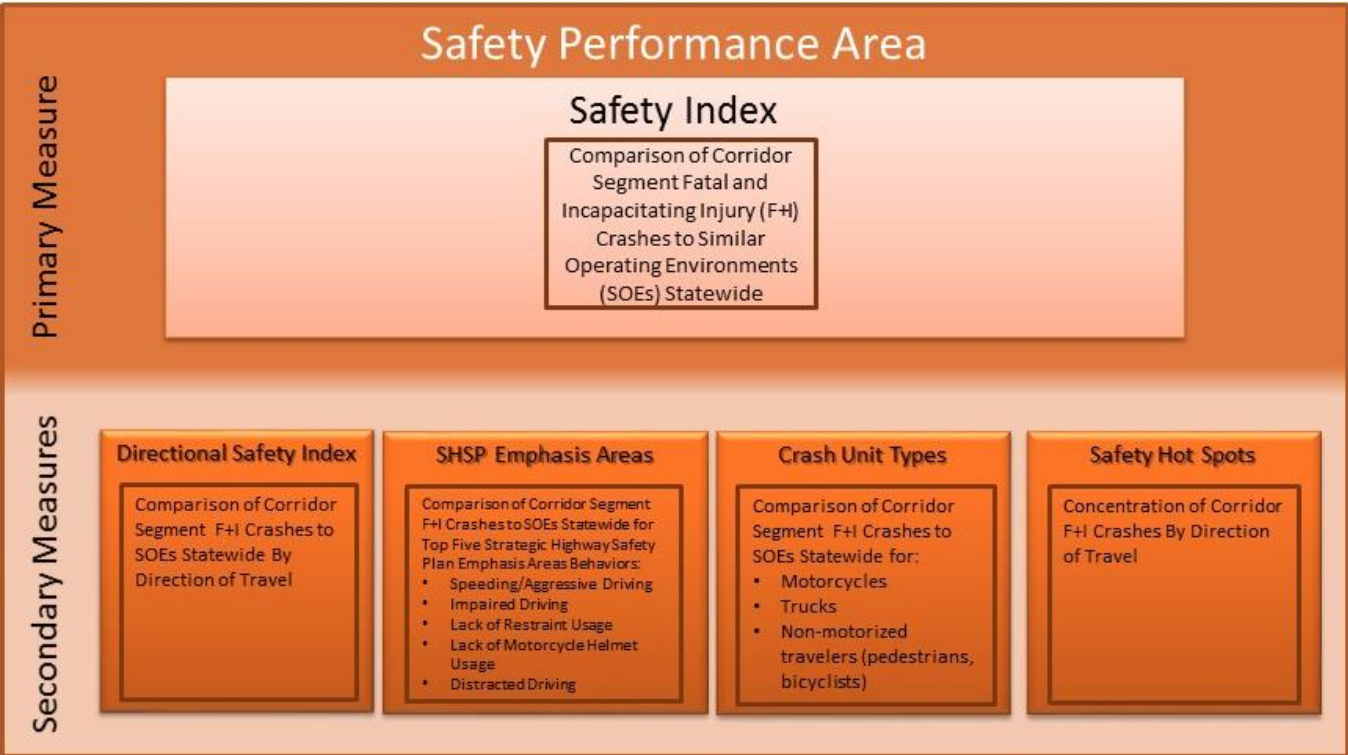
Figure 12: Mobility Performance



## 2.5 Safety Performance Area

The Safety performance area consists of a primary measure (Safety Index) and four secondary measures, as illustrated in **Figure 13**. All measures relate to crashes that result in fatal and incapacitating injuries, as these types of crashes are the emphasis of the ADOT Strategic Highway Safety Plan (SHSP), FHWA, and MAP-21. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

**Figure 13: Safety Performance Measures**



### Primary Safety Index

The Safety Index is based on the bi-directional frequency and rate of fatal and incapacitating injury crashes, the relative cost of those types of crashes, and crash occurrences on similar roadways in Arizona. According to ADOT's 2010 Highway Safety Improvement Program Manual, fatal crashes have an estimated cost that is 14.5 times the estimated cost of incapacitating injury crashes (\$5.8 million compared to \$400,000).

Each corridor segment is rated on a scale by comparing the segment score with the average statewide score for similar operating environments. Since crash frequencies and rates vary depending on the operating environment of a particular roadway, statewide values were developed for similar operating environments defined by functional classification, urban vs. rural setting, number of travel lanes, and traffic volumes.

For US 60|US 70|US 191, the following operating environments were identified:

- 2 or 3 Lane Undivided Highway (Segments 1-2; 4; 7-12; 14-16)
- 4 or 5 Lane Undivided Highway (Segments 5-6; 13)
- 2, 3 or 4 Lane Divided Highway (Segments 3; 17)

### Secondary Measures

Four secondary measures provide an in-depth evaluation of the different characteristics of safety performance:

#### *Directional Safety Index*

- This measure is based on the directional frequency and rate of fatal and incapacitating injury crashes

#### *SHSP Emphasis Areas*

ADOT's 2014 SHSP identified several emphasis areas for reducing fatal and incapacitating injury crashes. This measure compared rates of crashes in the top five SHSP emphasis areas to other corridors with a similar operating environment. The top five SHSP emphasis areas related to the following driver behaviors:

- Speeding and aggressive driving
- Impaired driving
- Lack of restraint usage
- Lack of motorcycle helmet usage
- Distracted driving

#### *Crash Unit Types*

- The percentage of total fatal and incapacitating injury crashes that involves crash unit types of motorcycles, trucks, or non-motorized travelers is compared to the statewide average on roads with similar operating environments

#### *Safety Hot Spots*

- The hot spot analysis identifies abnormally high concentrations of fatal and incapacitating injury crashes along the study corridor by direction of travel

### Safety Performance Results

The Safety Index provides a high-level assessment of safety performance for the corridor and for each segment. The four secondary measures provide more detailed information to assess safety performance.

The scale for ratings for all of the Safety performance measures depend on the crash history on similar statewide operating environments. Based on the results of this analysis, the following observations were made:

- Overall, based on the weighted average of the Safety Index, the corridor rates in “average performance” condition
- Five segments have insufficient data to determine the Safety Index.
- Seven of the segments perform above average or average and the remaining are “below average performance” in the Safety Index
- Most of the segments have insufficient data to assess the percent of fatal and incapacitating injury crashes involving SHSP top 5 emphasis area behaviors, however Segments 70-6 and 70|60-13 perform below average.

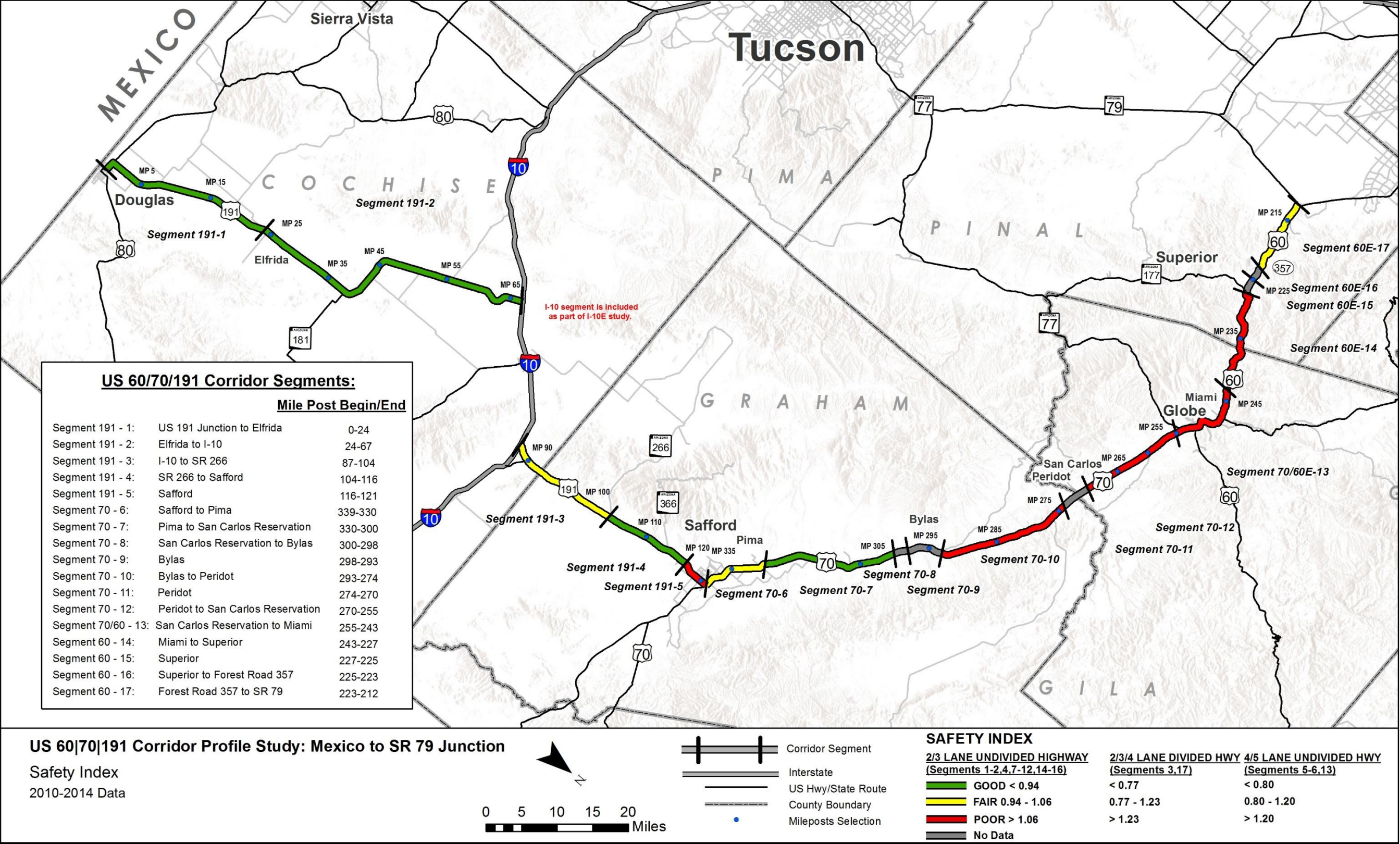
**Table 8** summarizes the Safety performance results for the US 60|US 70|US 191 corridor. **Figure 14** illustrates the primary Safety Index performance and locations of Safety hot spots along the US 60|US 70|US 191 corridor. Maps for each secondary measure can be found in **Appendix A**.

**Table 8: Safety Performance**

Segment #	Segment Length (miles)	Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors
			NB/WB	SB/EB	
191 - 1	24	0.44	0.10	0.78	Insufficient Data
191 - 2	43	0.28	0.53	0.03	Insufficient Data
191 - 3	17	1.00	0.00	2.00	Insufficient Data
191 - 4	12	0.03	0.07	0.00	Insufficient Data
191 - 5	5	1.30	1.34	1.25	Insufficient Data
70 - 6	9	0.93	1.68	0.18	73%
70 - 7	19	0.10	0.20	0.00	Insufficient Data
70 - 8	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
70 - 9	5	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
70 - 10	19	1.88	1.50	2.25	Insufficient Data
70 - 11	4	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
70 - 12	15	1.67	1.67	1.67	Insufficient Data
70 60 - 13	12	2.09	1.64	2.55	56%
60 - 14	16	3.23	2.23	4.23	55%
60 - 15	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
60 - 16	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
60 - 17	11	0.81	1.28	0.33	42%
Weighted Corridor Average		1.01	0.87	1.15	
SCALE					
Performance Level	2 or 3 Lane Undivided Highway: Segments 1-2; 4; 7-12; 14-16				
	2, 3 or 4 Lane Divided Highway: Segments 3; 17				
	4 or 5 Lane Undivided Highway: Segments 5-6; 13				
Above Average	$\leq 0.94$		< 51.2%		
	$\leq 0.77$		< 44.4%		
	$\leq 0.80$		< 42.4%		
Average	0.94-1.06		51.2% - 57.5%		
	0.77-1.23		44.4% - 54.4%		
	0.80-1.20		42.4% - 51.1%		
Below Average	$\geq 1.06$		> 57.5%		
	$\geq 1.23$		> 54.4%		
	$\geq 1.20$		> 51.1%		

Note: “Insufficient Data” indicates there was not enough data available to generate reliable performance ratings.

Figure 14: Safety Performance



## 2.6 Freight Performance Area

The Freight performance area consists of a single primary measure (Freight Index) and five secondary measures, as illustrated in **Figure 15**. All measures related to the reliability of truck travel as measured by observed truck travel time speed and delays to truck travel from freeway closures or physical restrictions to truck travel. The detailed calculations and equations developed for each measure are available in **Appendix B** and the performance data for this corridor is contained in **Appendix C**.

**Figure 15: Freight Performance Measures**



### Primary Freight Index

The Freight Index is a reliability performance measure based on the PTI for truck travel. The Truck Planning Time Index (TPTI) is the ratio of the 95<sup>th</sup> percentile truck travel time to the free-flow truck travel time. The TPTI reflects the extra buffer time needed for on-time delivery while accounting for non-recurring delay. Non-recurring delay refers to unexpected or abnormal delay due to closures or restrictions resulting from circumstances such as crashes, inclement weather, and construction activities.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the Freight performance area, the relevant operating environments are interrupted flow (e.g., signalized at-grade intersections are present) and uninterrupted flow (e.g., controlled access grade-separated conditions such as a freeway or interstate highway).

For US 60|US 70|US 191, the following operating environments were identified:

- Urban Interrupted (Segments 5-6; 13)
- Rural Uninterrupted (Segments 3-4; 7-12; 14-17)
- Rural Interrupted (Segments 1-2)

The Freight performance area includes five secondary measures that provide an in-depth evaluation of the different characteristics of freight performance:

### *Recurring Delay (Directional Truck Travel Time Index (TTTI))*

- The ratio of the average peak period truck travel time to the free-flow truck travel time (based on the posted speed limit up to a maximum of 65 miles per hour) in a given direction
- The TTTI recognizes the delay potential from recurring congestion during peak periods; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics

### *Non-Recurring Delay (Directional TPTI)*

- The ratio of the 95<sup>th</sup> percentile truck travel time to the free-flow truck travel time (based on the posted speed limit up to a maximum of 65 miles per hour) in a given direction
- The TPTI recognizes the delay potential from non-recurring delays such as traffic crashes, weather, or other incidents; different thresholds are applied to uninterrupted flow (freeways) and interrupted flow (non-freeways) to account for flow characteristics
- The TPTI indicates the amount of time in addition to the typical travel time that should be allocated to make an on-time trip 95% of the time in a given direction

### *Closure Duration*

- The average time (in minutes) a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel; a weighted average is applied to each closure that takes into account the distance over which the closure occurs

### *Bridge Vertical Clearance*

- The minimum vertical clearance (in feet) over the travel lanes for underpass structures on each segment

### *Bridge Vertical Clearance Hot Spots*

- A Bridge vertical clearance “hot spot” exists where the underpass vertical clearance over the mainline travel lanes is less than 16.25 feet and no exit/entrance ramps exist to allow vehicles to bypass the low clearance location
- If a location with a vertical clearance less than 16.25 feet can be avoided by using immediately adjacent exit/entrance ramps rather than the mainline, it is not considered a hot spot

### Freight Performance Results

The Freight Index provides a high-level assessment of freight mobility for the corridor and for each segment. The five secondary measures provide more detailed information to assess freight performance.

Each corridor segment is rated on a scale with other segments in similar operating environments. Within the freight performance area, the relevant operating environments included interrupted flow (where signalized at-grade intersections are present) and uninterrupted flow (roads with only controlled access grade-separated conditions such as a freeway or interstate highway).

Based on the results of this analysis, the following observations were made:

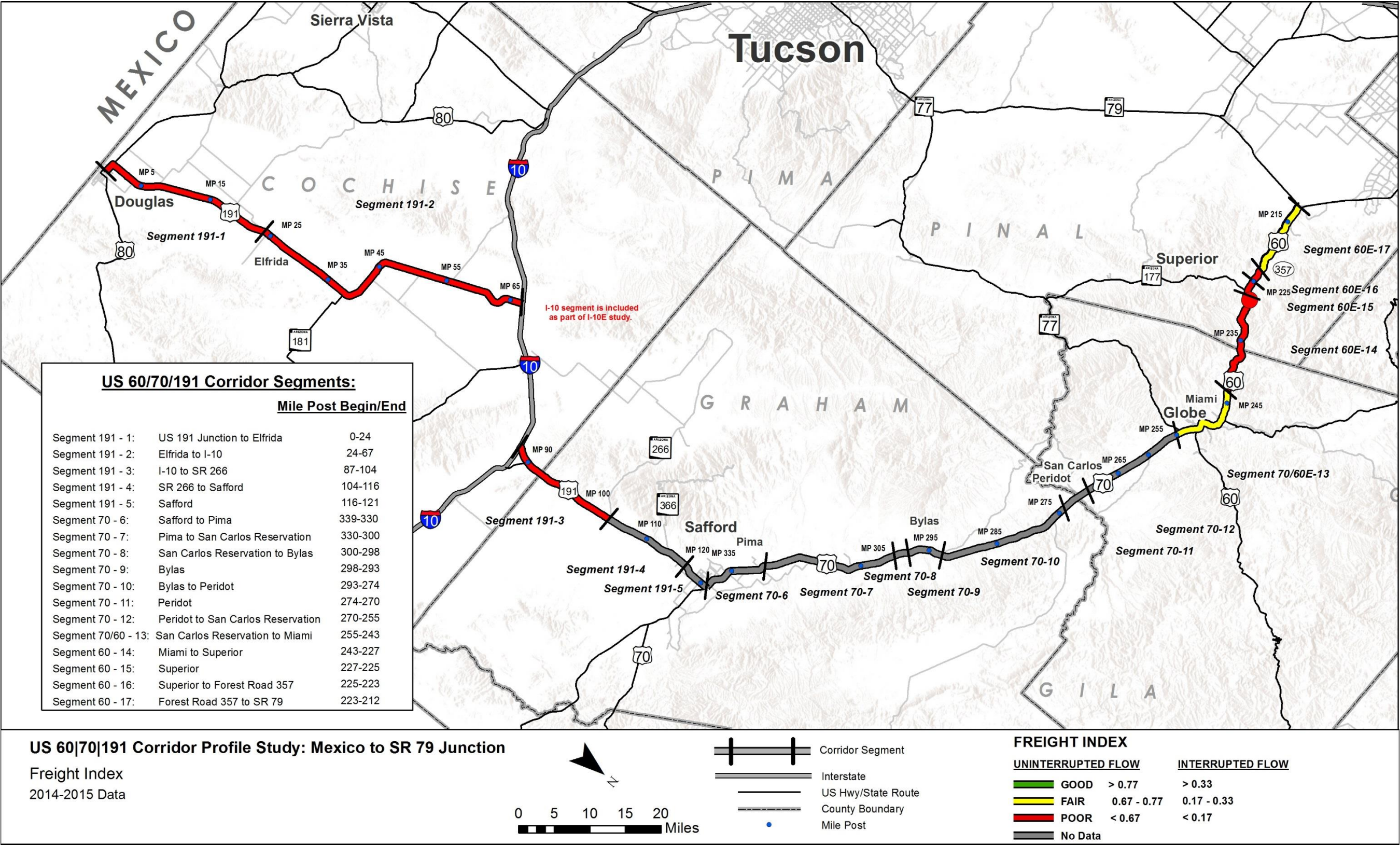
- Overall, based on the weighted average of the Freight Index, the freight mobility is in “poor” condition, although nine segments did not have a calculated Freight Index due to lack of data.
- The segments show varied performance in the Freight Index, TTTI and TPTI. The TPTI measures “poor” for the majority of the corridor in both directions of travel.
- A majority of the segments show “good” performance in the closure performance measure
- Segments 70-12, 60-14, 60-15, and 60-16 have the longest duration of closures
- Two locations have vertical clearance restrictions that cannot be by-passed, including one bridge in Segment 70|60-13 and the Queen Creek Tunnel in Segment 60-14

**Table 9** summarizes the Freight performance results for the US 60|US 70|US 191 corridor. **Figure 16** illustrates the primary Freight Index performance and locations of freight hot spots along US 60|US 70|US 191. Maps for each secondary measure can be found in **Appendix A**.

**Table 9: Freight Performance**

Segment #	Segment Length (miles)	Freight Index	Directional Truck TTTI		Directional Truck TPTI		Closure Duration (minutes/mile post/year/mile)		Vertical Bridge Clearance (feet)
			NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	
191 - 1	24	0.10	1.94	1.60	9.11	11.62	6.78	0.61	No UP
191 - 2	43	0.09	1.00	1.54	2.68	19.67	2.41	0.70	22.04
191 - 3	17	0.08	1.34	1.82	8.92	17.43	2.94	0.00	No UP
191 - 4	12	N/A	N/A	N/A	N/A	N/A	3.37	4.02	No UP
191 - 5	5	N/A	N/A	N/A	N/A	N/A	26.32	40.04	None
70 - 6	9	N/A	N/A	N/A	N/A	N/A	3.96	16.64	No UP
70 - 7	19	N/A	N/A	N/A	N/A	N/A	2.42	0.00	17.03
70 - 8	2	N/A	N/A	N/A	N/A	N/A	0.00	22.10	No UP
70 - 9	5	N/A	N/A	N/A	N/A	N/A	0.00	15.52	None
70 - 10	19	N/A	N/A	N/A	N/A	N/A	21.73	25.56	No UP
70 - 11	4	N/A	N/A	N/A	N/A	N/A	27.45	0.00	No UP
70 - 12	15	N/A	N/A	1.14	N/A	2.01	7.71	127.15	No UP
70 60 - 13	12	0.19	1.24	1.48	4.29	6.19	0.00	19.07	15.84
60 - 14	16	0.43	1.18	1.60	2.34	2.36	68.54	378.72	13.03
60 - 15	2	0.33	1.13	1.25	1.87	4.23	107.46	249.09	16.79
60 - 16	2	0.49	1.14	1.00	2.98	1.12	108.80	0.00	No UP
60 - 17	11	0.72	1.07	1.14	1.23	1.54	13.65	19.62	No UP
Weighted Corridor Average		0.52					13.31	45.89	
SCALE									
Performance Level		Uninterrupted: Segments 3-4; 7-12; 14-17 Interrupted: Segments 1-2; 5-6; 13				All			
Good		> 0.77 > 0.33	< 1.15 < 1.30		< 1.3 < 3.0		< 44.18		> 16.5
Fair		0.67-0.77 0.17-0.33	1.15-1.33 1.30-2.0		1.3-1.5 3.0-6.0		44.18-124.86		16.0-16.5
Poor		< 0.67 < 0.17	> 1.33 > 2.0		> 1.5 > 6.0		> 124.86		< 16.0

Figure 16: Freight Performance



### 2.7 Corridor Performance Summary

Based on the results presented in the preceding sections, the following general observations were made related to the performance of the US 60|US 70|US 191 corridor:

- **Overall performance** within all five areas evaluated is split between “good” (41%), “fair” (29%) and “poor” (31%) ratings.
- **Pavement Performance:** All of the 214 miles on the US 60|US 70|US 191 corridor rate as “good” or “fair” for the overall Pavement Index. Due to the significant areas of roughness and pavement cracking, 3 of the 9 segments rate poorly for percentage of area in failure.
- **Bridge Performance:** A total of 48 bridges were included in the evaluation. Four bridges on US 60 are considered structurally deficient, including Queen Creek Bridge (MP 227.71, No. 406), Waterfall Canyon Bridge (MP 229.50, No. 328), Pinto Creek Bridge (MP 238.25, No. 351), and Pinal Creek Bridge (MP 249.64, No. 266).
- **Mobility Performance:** US 60|US 70|US 191 corridor is considered to have two operating environments for evaluating Mobility. These include Urban/Fringe Urban Highway and Rural Highway. Both the current and future capacity is considered “good” with the exception of Segments 60-14 and 60-15, the area between Miami and Superior, which has mountainous terrain.
- **Safety Performance:** Safety performance utilizes the three operating environments for analysis that compare fatal and incapacitating injury crashes to other similar routes statewide. The US 60|US 70|US 191 corridor is mixed between “good” and “poor” ratings. Higher than average fatal crashes occurred on Segments 70-9 and 70-12 through 70-14, with an additional five segments having insufficient crash data.
- **Freight Performance:** The performance of freight mobility is overall “poor” within the US 60|US 70|US 191 corridor. This is primarily due to the high PTI. Traffic counters do not exist in 9 of the 17 segments, which does not allow for the performance to be measured for TTI and PTI for much of the corridor.
- **Poorest Performing Segment:** Segment 60-14 rated lower in performance than the other segments in the corridor. Bridge, Safety and Freight Indices all rated as “poor” performance. Pavement and Mobility Indices measured as “fair”.
- **Highest Performing Segments:** Segments 191-4, 70-7, 70-8 and 60-17 do not have any “poor” performance areas. Segment 70-8, in the Bylas area on the San Carlos Apache Reservation, rated the best performance though this segment is only 2 miles in length.

**Figure 17** shows the percentage of the US 60|US 70|US 191 corridor that rates either “good/above average performance”, “fair/average performance”, or “poor/below average performance” in each Index.

**Table 10** shows a summary of all primary and secondary performance measures for the US 60|US 70|US 191 corridor. A weighted average rating (based on the length of the segment) was calculated for each primary and secondary measure – this is shown in the last row of **Table 10**. The weighted average ratings are summarized in **Figure 18** which also provides a brief description of each performance measure. **Figure 18** represents the average for the entire corridor, and any given segment or location could have a higher or lower rating than the corridor average.

**Figure 17: Performance Summary by Primary Measure**

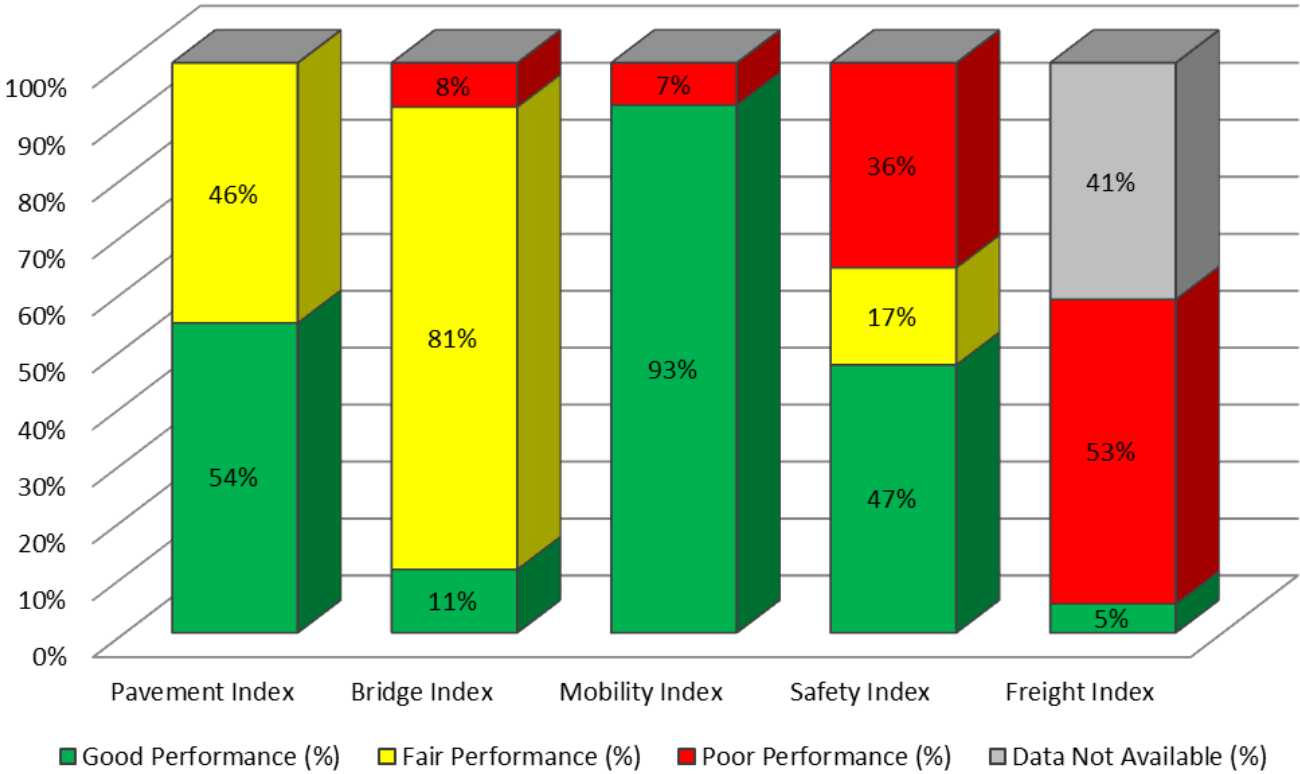


Figure 18: Corridor Performance Summary by Performance Measure

Pavement	Bridge	Mobility	Safety	Freight
<b>Pavement Index (PI):</b> based on two pavement condition ratings from the ADOT Pavement Database; the two ratings are the International Roughness Index (IRI) and the Cracking Rating.	<b>Bridge Index (BI):</b> based on four bridge condition ratings from the ADOT Bridge Database. The four ratings are the Deck Rating, Substructure Rating, Superstructure Rating, and Structural Evaluation Rating.	<b>Mobility Index (MI):</b> an average of the existing daily volume-to-capacity (V/C) ratio and the projected 2035 daily V/C ratio	<b>Safety Index (SI):</b> combines the bi-directional frequency and rate of fatal and incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona	<b>Freight Index (FI):</b> a reliability performance measure based on the bi-directional planning time index for truck travel.
<ul style="list-style-type: none"> <li>➤ <b>Directional Pavement Serviceability Rating (PSR)</b> – the weighted average (based on number of lanes) of the PSR for the pavement in each direction of travel</li> <li>➤ <b>% Area Failure</b> – the percentage of pavement area rated above failure thresholds for IRI or Cracking</li> </ul>	<ul style="list-style-type: none"> <li>➤ <b>Sufficiency Rating</b>– multipart rating includes structural adequacy and safety factors as well as functional aspects such as traffic volume and length of detour</li> <li>➤ <b>% of Deck Area on Functionally Obsolete Bridges</b>– the percentage of deck area in a segment that is on functionally obsolete bridges; identifies bridges that no longer meet standards for current traffic volumes, lane width, shoulder width, or bridge rails; a bridge that is functionally obsolete may still be structurally sound</li> <li>➤ <b>Lowest Bridge Rating</b>–the lowest rating of the four bridge condition ratings on each segment</li> </ul>	<ul style="list-style-type: none"> <li>➤ <b>Future Daily V/C</b> – the future 2035 V/C ratio provides a measure of future congestion if no capacity improvements are made to the corridor</li> <li>➤ <b>Existing Peak Hour V/C</b> – the existing peak hour V/C ratio for each direction of travel provides a measure of existing peak hour congestion during typical weekdays</li> <li>➤ <b>Closure Extent</b> – the average number of instances a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel</li> <li>➤ <b>Directional Travel Time Index (TTI)</b> – the ratio of the average peak period travel time to the free-flow travel time; the TTI represents recurring delay along the corridor</li> <li>➤ <b>Directional Planning Time Index (PTI)</b> – the ratio of the 95<sup>th</sup> percentile travel time to the free-flow travel time; the PTI represents non-recurring delay along the corridor</li> <li>➤ <b>% Bicycle Accommodation</b> – the percentage of a segment that accommodates bicycle travel</li> <li>➤ <b>% Non-single Occupancy Vehicle (Non-SOV) Trips</b> – the percentage of trips that are taken by vehicles carrying more than one occupant</li> </ul>	<ul style="list-style-type: none"> <li>➤ <b>Directional Safety Index</b> – the combination of the directional frequency and rate of fatal and incapacitating injury crashes, compared to crash occurrences on similar roadways in Arizona</li> <li>➤ <b>% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors</b> – the percentage of fatal and incapacitating crashes that involve at least one of the five Strategic Highway Safety Plan (SHSP) emphasis areas on a given segment compared to the statewide average percentage on roads with similar operating environments</li> <li>➤ <b>% of Fatal + Incapacitating Crashes Involving SHSP Crash Unit Types</b> – the percentage of total fatal and incapacitating injury crashes that involves a given crash unit type (motorcycle, truck, non-motorized traveler) compared to the statewide average percentage on roads with similar operating environments.</li> </ul>	<ul style="list-style-type: none"> <li>➤ <b>Directional Truck Travel Time Index (TTTI)</b> – the ratio of the average peak period truck travel time to the free-flow truck travel time; the TTTI represents recurring delay along the corridor</li> <li>➤ <b>Directional Truck Planning Time Index (TPTI)</b> – the ratio the 95<sup>th</sup> percentile truck travel time to the free-flow truck travel time; the TPTI represents non-recurring delay along the corridor</li> <li>➤ <b>Closure Duration</b> – the average time a particular milepost is closed per year per mile on a given segment of the corridor in a specific direction of travel</li> <li>➤ <b>Bridge Vertical Clearance</b> – the minimum vertical clearance over the travel lanes for underpass structures on each segment</li> </ul>

Table 10: Corridor Performance Summary by Segment and Performance Measure

Segment #	Segment Length (miles)	Pavement Performance Area				Bridge Performance Area				Mobility Performance Area												
		Pavement Index	Directional PSR		% Area Failure	Bridge Index	Sufficiency Rating	% of Deck Area on Functionally Obsolete Bridges	Lowest Bridge Rating	Mobility Index	Future Daily V/C	Existing Hour V/C		Closure Extent (instances/milepost/year/mile)		Directional TTI (all vehicles)		Directional PTI (all vehicles)		% Bicycle Accommodation	% Non-Single Occupancy Vehicle (SOV) Trips	
			NB/WB	SB/EB								NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB			
191-12*	24	3.64	3.37	3.37	0%	6.00	89.00	0%	6	0.15	0.17	0.12	0.12	0.03	0.01	1.51	1.30	4.79	7.47	66%	12.5%	
191-22*	43	3.06	3.31	3.31	30%	5.37	76.93	0%	5	0.09	0.10	0.07	0.07	0.02	0.00	1.16	1.16	9.83	6.09	100%	16.0%	
191-32^	17	3.93	3.94	4.02	3%	6.02	93.91	0%	5	0.04	0.04	0.03	0.03	0.01	0.00	1.39	1.20	9.51	11.62	49%	9.8%	
191-42^	12	3.28	3.28	3.28	17%	6.00	69.50	0%	6	0.18	0.20	0.14	0.14	0.03	0.03	No Data				96%	9.3%	
191-51*	5	3.28	3.28	3.28	20%	No Bridges				0.33	0.39	0.27	0.28	0.12	0.08	No Data				27%	22.5%	
70-61*	9	3.70	3.44	3.44	10%	6.00	69.10	0%	6	0.53	0.69	0.32	0.32	0.02	0.06	No Data				46%	19.0%	
70-72^	19	3.43	3.35	3.35	5%	5.77	71.59	0%	5	0.18	0.21	0.13	0.13	0.02	0.00	No Data				73%	16.8%	
70-82^	2	3.87	3.78	3.78	0%	6.00	74.00	0%	6	0.12	0.15	0.08	0.08	0.00	0.10	No Data				0%	13.8%	
70-92^	5	3.81	3.80	3.80	0%	No Bridges				0.25	0.29	0.16	0.17	0.00	0.04	No Data				26%	12.2%	
70-102^	19	3.87	3.55	3.55	5%	7.00	80.00	0%	7	0.17	0.19	0.11	0.11	0.09	0.04	No Data				4%	8.9%	
70-112^	4	3.88	3.55	3.55	0%	7.54	82.03	0%	5	0.21	0.26	0.12	0.12	0.10	0.00	No Data				4%	13.7%	
70-122^	15	3.97	3.83	3.83	0%	6.00	63.20	0%	6	0.19	0.23	0.13	0.13	0.04	0.31	No Data	1.10	No Data	1.40	23%	12.1%	
70 60-131*	12	3.65	3.43	3.34	19%	5.17	78.89	49%	4	0.40	0.46	0.29	0.30	0.00	0.12	1.15	1.31	2.72	3.36	54%	17.0%	
60-142^	16	3.43	3.24	3.24	31%	4.56	18.49	0%	4	1.73	2.11	1.22	1.09	0.33	1.57	1.07	1.19	1.47	2.06	49%	15.0%	
60-152^	2	3.21	2.92	2.92	50%	6.00	83.70	57%	6	2.76	3.83	1.28	1.30	0.36	1.17	1.08	1.17	1.67	2.30	95%	13.0%	
60-162^	2	3.32	3.38	3.38	0%	5.00	86.66	0%	5	0.54	0.71	0.28	0.28	0.50	0.00	1.09	1.00	1.91	1.04	87%	9.0%	
60-172^	11	4.30	4.14	4.02	0%	6.42	91.11	0%	5	0.20	0.26	0.11	0.10	0.09	0.05	1.01	1.01	1.16	1.24	96%	10.0%	
Weighted Corridor Average		3.57	3.49	3.49	13%	5.56	72.20	3%	5	0.32	0.39	0.22	0.21	0.06	0.17					61%	14%	
SCALE																						
Performance Level		Non-Interstate				All				Urban <sup>1</sup> Rural <sup>2</sup>				All		Uninterrupted ^ Interrupted *					All	
Good / Above Average		> 3.50				< 5%	> 6.5	> 80	< 12%	> 6	≤ 0.71 (Urban) ≤ 0.56 (Rural)				< 0.22		≤ 1.15 ≤ 1.3		≤ 1.3 ≤ 3.0		> 90%	> 17%
Fair / Average		2.9 - 3.5				5%-20%	5.0 - 6.5	50 - 80	12% - 40%	5 - 6	0.71 - 0.89 (Urban) 0.56 - 0.76 (Rural)				0.22 - 0.62		1.15 - 1.33 ≤ 1.3		1.3 - 1.5 3.0 - 6.0		90% - 60%	17% - 11%
Poor / Average		< 2.90				> 20%	< 5.0	< 50	> 40%	< 5	> 0.89 (Urban) > 0.76 (Rural)				≥ 0.62		≥ 1.33 ≥ 2.0		≥ 1.5 ≥ 6.0		< 60%	< 11%

<sup>1</sup> Urban or Fringe Urban Operating Environment

<sup>2</sup> Rural Operating Environment

<sup>^</sup> Uninterrupted

<sup>\*</sup> Interrupted

**Table 10: Corridor Performance Summary by Segment and Performance Measure (continued)**

Segment #	Segment Length (miles)	Safety Performance Area							Freight Performance Area							
		Safety Index	Directional Safety Index		% of Fatal + Incapacitating Injury Crashes Involving SHSP Top 5 Emphasis Areas Behaviors	% of Fatal + Incapacitating Injury Crashes Involving Trucks	% of Fatal + Incapacitating Injury Crashes Involving Motorcycles	% of Segment Fatal + Incapacitating Injury Crashes Involving Non-Motorized Travelers	Freight Index	Directional TTTI (trucks only)		Directional TPTI (trucks only)		Closure Duration (mins/milepost/closed/year/ mile)		Bridge Vertical Clearance (feet)
			NB/WB	SB/EB						NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	
191-1a*	24	0.44	0.10	0.78	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.10	1.94	1.60	9.11	11.62	6.78	0.61	No UP
191-2a*	43	0.28	0.53	0.03	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.09	1.00	1.54	2.68	19.67	2.41	0.70	22.04
191-3b^	17	1.00	0.00	2.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.08	1.34	1.82	8.92	17.43	2.94	0.00	No UP
191-4a^	12	0.03	0.07	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					3.37	4.02	No UP
191-5c*	5	1.30	1.34	1.25	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					26.32	40.04	No UP
70-6c*	9	0.93	1.68	0.18	73%	Insufficient Data	Insufficient Data	Insufficient Data	No Data					3.96	16.64	No UP
70-7a^	19	0.10	0.20	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					2.42	0.00	17.03
70-8a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					0.00	22.10	No UP
70-9a^	5	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					0.00	15.52	No UP
70-10a^	19	1.88	1.50	2.25	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					21.73	25.56	No UP
70-11a^	4	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data					27.45	0.00	No UP
70-12a^	15	1.67	1.67	1.67	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	No Data		1.14	No Data	2.01	7.71	127.15	No UP
70 60-13c*	12	2.09	1.64	2.55	57%	Insufficient Data	Insufficient Data	Insufficient Data	0.19	1.24	1.46	4.29	6.19	0.00	19.07	15.84
60-14a^	16	3.23	2.23	4.23	55%	Insufficient Data	Insufficient Data	Insufficient Data	0.43	1.18	1.60	2.34	2.36	68.54	378.72	13.03
60-15a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.33	1.13	1.25	1.87	4.23	107.46	249.09	16.79
60-16a^	2	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.49	1.14	1.00	2.98	1.12	108.80	0.00	No UP
60-17b^	11	0.81	1.28	0.33	42%	Insufficient Data	Insufficient Data	Insufficient Data	0.72	1.07	1.14	1.23	1.54	13.65	19.62	No UP
Weighted Corridor Averages		1.01	0.87	1.15					0.52					13.31	45.89	
SCALE																
Performance Level		2 or 3 Lane Undivided Highway 2, 3 or 4 Lane Divided Highway 4 or 5 Lane Undivided Highway							Uninterrupted Interrupted					All		
Good/Above Average		a	≤ 0.94		< 51.2%	< 5.2%	< 18.5%	< 2.2%	> 0.77 > 0.33	<1.15 < 1.30	< 1.3 ≤ 3.0	< 44.18		> 16.5		
		b	≤ 0.77		< 44.4%	< 3.5%	< 16.3%	< 2.4%								
		c	≤ 0.80		< 42.4%	< 6.1%	< 6.4%	< 4.7%								
Fair/Average		a	0.94-1.06		51.2% - 57.5%	5.2% - 7.1%	18.5% - 26.5%	2.2%-4.2%	0.67-0.77 0.17-0.33	1.15-1.33 1.30-2.0	1.3-1.5 3.0-6.0	44.18-124.86		16.0-16.5		
		b	0.77-1.23		44.4% - 54.4%	3.5% - 7.3%	16.3% - 26.3%	2.4%-4.5%								
		c	0.80-1.20		42.4% - 51.1%	6.1% - 9.6%	6.4% - 9.4%	4.7%-7.9%								
Poor/Below Average		a	≥ 1.06		> 57.5%	> 7.1%	> 26.5%	> 4.2%	< 0.67 <0.17	>1.33 > 2.0	> 1.5 > 6.0	> 124.86		<16.0		
		b	≥ 1.23		> 54.4%	>7.3%	> 26.3%	> 4.5%								
		c	≥ 1.20		> 51.1%	> 9.6%	> 9.4%	> 7.9%								

<sup>a</sup> 2 or 3 Lane Undivided

<sup>b</sup> 2,3 or 4 Lane Divided

<sup>c</sup> 4 or 5 Lane Undivided

<sup>^</sup> Uninterrupted

<sup>\*</sup> Interrupted

*Note: "Insufficient Data" indicates there was not enough data available to generate reliable performance ratings  
 "No UP" indicates no underpasses are present in the segment*

### 3.0 NEEDS ASSESSMENT

#### 3.1 Corridor Objectives

Statewide goals and performance measures were established by the ADOT Long-Range Transportation Plan (LRTP), 2010-2035. Statewide performance goals that are relevant to US 60|US 70|US 191 performance areas were identified and corridor goals were then formulated for each of the five performance areas that aligned with the overall statewide goals established by the LRTP. Based on stakeholder input, corridor goals, corridor objectives, and performance results, three “emphasis areas” were identified for the US 60|US 70|US 191 corridor: Mobility, Safety, and Freight.

Taking into account the corridor goals and identified emphasis areas, performance objectives were developed for each quantifiable performance measure that identify the desired level of performance based on the performance scale levels for the overall corridor and for each segment of the corridor. For the performance emphasis areas, the corridor-wide weighted average performance objectives are identified with a higher standard than for the other performance areas. **Table 11** shows the US 60|US 70|US 191 corridor goals, corridor objectives, and performance objectives, and how they align with the statewide goals.

It is not reasonable within a financially constrained environment to expect that every performance measure will always be at the highest levels on every corridor segment. Therefore, individual corridor segment objectives have been set as fair or better and should not fall below that standard.

Achieving corridor and segment performance objectives will help ensure that investments are targeted toward improvements that support the safe and efficient movement of travelers on the corridor. Addressing current and future congestion, thereby improving mobility on congested segments, will also help the corridor fulfill its potential as a significant contributor to the region’s economy.

Corridor performance is measured against corridor and segment objectives to determine needs – the gap between observed performance and performance objectives.

Goal achievement will improve or reduce current and future congestion, increase travel time reliability, and reduce fatalities and incapacitating injuries resulting from vehicle crashes. Where performance is currently rated “good”, the goal is always to maintain that standard, regardless of whether or not the performance is in an emphasis area.

**Table 11: Corridor Performance Goals and Objectives**

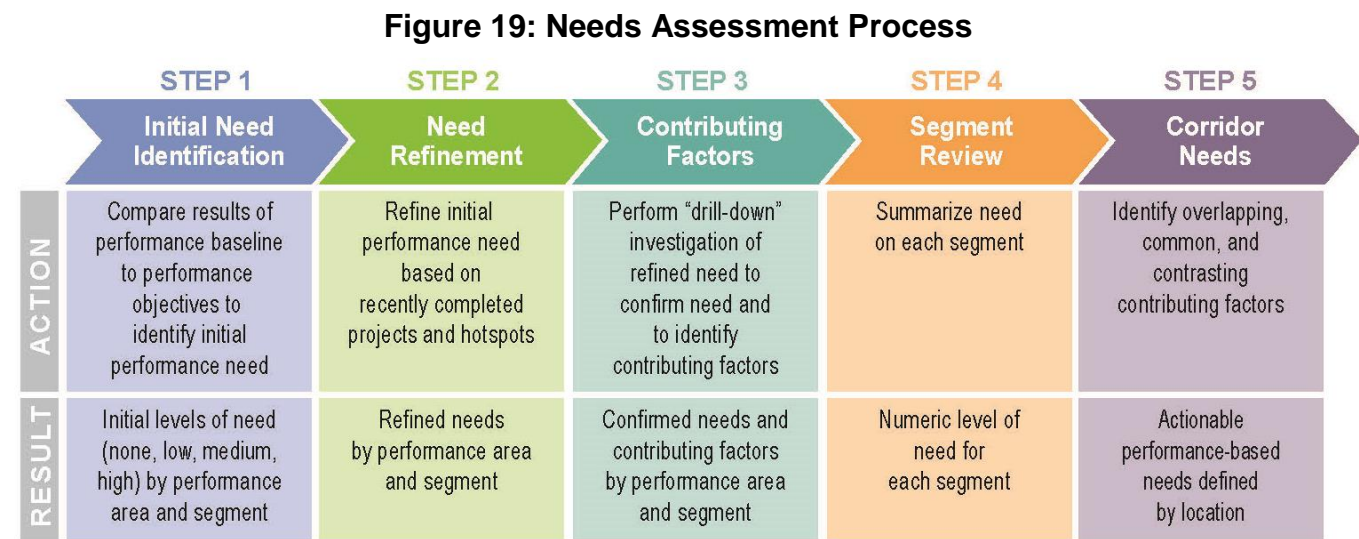
ADOT Statewide L RTP Goals	US 60 US 70 US 191 Corridor Goals	US 60 US 70 US 191 Corridor Objectives	Performance Area	Primary Index	Performance Objective	
				Secondary Measure Indicators	Corridor Average	Segment
<b>Improve Mobility and Accessibility</b>  <b>Support Economic Growth</b>	Provide a safe, reliable, and efficient connection for the communities along the corridor  Provide a safe and reliable route for recreational and tourist travel  Consider future land use when recommending infrastructure improvements since agricultural activities are transitioning to development activities	Reduce current and future congestion in the urbanized areas  Reduce delays from non-recurring events and incidents to improve reliability  Improve bicycle accommodation	Mobility (Emphasis Area)	<b>Mobility Index</b>  Future Daily V/C Existing Peak Hour V/C Closure Extent Directional Travel Time Index Directional Planning Time Index % Bicycle Accommodation % Non-SOV Trips	Good	Fair or Better
	Provide a safe, reliable and efficient freight route between Arizona and Mexico	Reduce delays and restrictions to freight movement to improve reliability  Improve travel time reliability (including impacts to motorists due to freight traffic)	Freight (Emphasis Area)	<b>Freight Index</b>  Directional Truck Travel Time Index Directional Truck Planning Time Index Closure Duration Bridge Vertical Clearance	Good	
<b>Preserve and Maintain the State Transportation System</b>	Preserve and modernize highway infrastructure  Provide an all-weather transportation facility	Maintain structural integrity of bridges  Improve pavement ride quality	Bridge  Pavement	<b>Bridge Index</b>  Sufficiency Rating % of Deck Area on Functionally Obsolete Bridges Lowest Bridge Rating  <b>Pavement Index</b>  Directional Pavement Serviceability Rating % Area Failure	Fair or Better  Fair or Better	Fair or Better  Fair or Better
	Promote safety by implementing appropriate countermeasures, particularly in mountainous and rolling terrain	Reduce fatal and serious injury crashes	Safety (Emphasis Area)	<b>Safety Index</b>  Directional Safety Index % of Crashes Involving SHSP Top 5 Emphasis Areas Behaviors % of Crashes Involving Crash Unit Types	Above Average	Average or Better

### 3.2 Needs Assessment Process

The following guiding principles were used as an initial step in developing a framework for the performance-based needs assessment process:

- Corridor needs are defined as the difference between the corridor performance and the performance objectives
- The needs assessment process should be systematic, progressive, and repeatable, but also allow for engineering judgment where needed
- The process should consider all primary and secondary performance measures developed for the study
- The process should develop multiple need levels including programmatic needs for the entire length of the corridor, performance area-specific needs, segment-specific needs, and location-specific needs (defined by MP limits)
- The process should produce actionable needs that can be addressed through strategic investments in corridor preservation, modernization, and expansion

The performance-based needs assessment process is illustrated in **Figure 19** and described in the following sections.



#### Step 1: Initial Needs Identification

The first step in the needs assessment process links baseline (existing) corridor performance with performance objectives. In this step, the baseline corridor performance is compared to the performance objectives to provide a starting point for the identification of performance needs. This mathematical comparison results in an initial need rating of None, Low, Medium, or High for each primary and secondary performance measure. An illustrative example of this process is shown below in **Figure 20**.

**Figure 20: Initial Need Ratings in Relation to Baseline Performance (Bridge Example)**

Performance Thresholds	Performance Level	Initial Level of Need*	Description
6.5	Good	None	All levels of Good and top 1/3 of Fair (>6.0)
	Good		
	Good		
	Fair		
5.0	Fair	Low	Middle 1/3 of Fair (5.5-6.0)
	Fair	Medium	Lower 1/3 of Fair and top 1/3 of Poor (4.5-5.5)
	Poor		
	Poor	High	Lower 2/3 of Poor (<4.5)
	Poor		

*\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

The initial level of need for each segment is refined to account for hot spots and recently completed or under construction projects, resulting in a final level of need for each segment. The final levels of need for each primary and secondary performance measure are combined to produce a weighted final need rating for each segment. Values of 0, 1, 2, and 3 are assigned to the initial need levels of None, Low, Medium, and High, respectively. A weight of 1.0 is applied to the Performance Index need and equal weights of 0.20 are applied to each need for each secondary performance measure. For directional secondary performance measures, each direction of travel receives a weight of 0.10.

### Step 2: Need Refinement

In Step 2, the initial level of need for each segment is refined using the following information and engineering judgment:

- For segments with an initial need of None that contain hot spots, the level of need should be increased from None to Low
- For segments with an initial level of need where recently completed projects or projects under construction are anticipated to partially or fully address the identified need, the level of need should be reduced or eliminated as appropriate
- Programmed projects that are expected to partially or fully address an identified need are not justification to lower the initial need because the programmed projects may not be implemented as planned; in addition, further investigations may suggest that changes in the scope of a programmed project may be warranted

The resulting final needs are carried forward for further evaluation in Step 3.

### Step 3: Contributing Factors

In Step 3, a more detailed review of the condition and performance data available from ADOT is conducted to identify contributing factors to the need. Typically, the same databases used to develop the baseline performance serve as the principal sources for the more detailed analysis. However, other supplemental databases may also be useful sources of information. The databases used for diagnostic analysis are listed below:

#### Pavement Performance Area

- Pavement Rating Database

#### Bridge Performance Area

- ABISS

#### Mobility Performance Area

- Highway Performance Monitoring System (HPMS) Database
- AZTDM
- Real-time traffic conditions data produced by American Digital Cartography Inc. (HERE) Database
- Highway Conditions Reporting System (HCRS) Database

#### Safety Performance Area

- Crash Database

#### Freight Performance Area

- HERE Database
- HCRS Database

In addition, other sources considered helpful in identifying contributing factors are:

- Maintenance history (from ADOT PeCoS database for pavement), the level of past investments, or trends in historical data that provide context for pavement and bridge history
- Field observations from ADOT district personnel can be used to provide additional information regarding a need that has been identified
- Previous studies can provide additional information regarding a need that has been identified

Step 3 results in the identification of performance-based needs and contributing factors by segment (and MP locations, if appropriate) that can be addressed through investments in preservation, modernization, and expansion projects to improve corridor performance. See **Appendix D** for more information.

### Step 4: Segment Review

In this step, the needs identified in Step 2 and refined in Step 3 are quantified for each segment to numerically estimate the level of need for each segment. Values of 0 to 3 are assigned to the final need levels (from Step 3) of None, Low, Medium, and High, respectively. A weighting factor is applied to the performance areas identified as emphasis areas and a weighted average need is calculated for each segment. The resulting average need score can be used to compare levels of need between segments within a corridor and between segments in different corridors.

### Step 5: Corridor Needs

In this step, the needs and contributing factors for each performance area are reviewed on a segment-by-segment basis to identify actionable needs and to facilitate the formation of solution sets that address multiple performance areas and contributing factors. The intent of this process is to identify overlapping, common, and contrasting needs to help develop strategic solutions. This step results in the identification of corridor needs by specific location.

## **3.3 Corridor Needs Assessment**

This section documents the results of the needs assessment process described in the prior section. The needs in each performance area were classified as either None, Low, Medium, or High based on how well each segment performed in the existing performance analysis. The needs for each segment were numerically combined to estimate the average level of need for each segment of the corridor

The final needs assessments for each performance measure, along with the scales used in analysis, are shown in **Table 12** through **Table 16**.

### Pavement Needs Refinement and Contributing Factors

Of the 214 corridor miles, approximately 119 miles (55%) exhibit a “Low” level of pavement need and 17 miles (17%) exhibit “Medium” level of pavement need. Pavement hot spot failure needs were identified for 17 miles on US 191, 3 miles on US 70, and 3 miles on US 60.

Key contributing factors are summarized below:

- A high level of historical investment has occurred on Segments 70-9 and 70-10 through the San Carlos Indian Reservation and a medium level of historical investment has occurred through the remaining corridor segments, excluding Segment 191-1.
- See other contributing factors in **Appendix D**.

**Table 12: Final Pavement Needs**

Segment #	Performance Score and Level of Need				Initial Segment Need*	Hot Spots	Recently Completed Projects	Final Segment Need*
	Pavement Index	Directional PSR		% Pavement Area Failure				
		NB/WB	SB/EB					
191-1	3.64	3.37	3.37	0.00%	None	None	None	None
191-2	3.06	3.31	3.31	30.23%	2.6	NB MP 24-27, NB MP 38-41, NB MP 45-46, NB MP 48-51, NB MP 62-64, NB MP 66-67	MP 25.54-37.97 (H8652): Double chip seal coat and replace pavement markings MP 37.97-45.80 (H8124): Mill existing pavement and replace with AC and new AR-ACFC MP 61.50-66.60 (H7883): Pavement rehabilitation including milling, replacement and AC overlay, applications of chip seal and paving turnouts	Low
191-3	3.93	3.94	4.02	2.94%	None	SB MP 87-88	MP 100.59-104.00 (H8185): Overlay the existing pavement with AC and AR-ACFC	Low
191-4	3.28	3.28	3.28	16.67%	1.6	NB MP 105-107	MP 104.00-104.52 (H8185): Overlay the existing pavement with AC and AR-ACFC	Medium
191-5	3.28	3.28	3.28	20.00%	1.6	NB MP 120-121	None	Medium
70-6	3.70	3.44	3.44	10.00%	None	WB MP 336-337	None	Low
70-7	3.43	3.35	3.35	5.26%	None	WB MP 300-301	None	Low
70-8	3.87	3.78	3.78	0.00%	None	None	None	None
70-9	3.81	3.80	3.80	0.00%	None	None	None	None

Table 12: Final Pavement Needs (continued)

Segment #	Performance Score and Level of Need				Initial Segment Need*	Hot Spots	Recently Completed Projects	Final Segment Need*
	Pavement Index	Directional PSR		% Pavement Area Failure				
		EB	WB					
70-10	3.87	3.55	3.55	5.26%	None	WB MP 283-284	<b>MP 275.0-279.5 (H8185):</b> Milling and replace with AC and new AR-ACFC plus Fog Coat of shoulders  <b>MP 291.81- 293.74 (H6910):</b> Remove the existing 23-span steel girder bridge and replace it with a 15-span precast prestressed concrete AASHTO Type VI girder bridge. The project includes roadway approach widening.	Low
70-11	3.88	3.55	3.55	0.00%	None	None	None	None
70-12	3.97	3.83	3.83	0.00%	None	None	None	None
70 60-13	3.65	3.43	3.34	18.52%	0.4	EB MP 247-248, EB MP 249-251	None	Low
60-14	3.43	3.24	3.24	31.25%	0.8	None	<b>MP 229.48-241.93 (H5818):</b> Construct climbing and passing lanes	None
60-15	3.21	2.92	2.92	50.00%	2.0	WB MP 226-227	<b>MP 225-226.87 (H7900):</b> Reconstruct existing 2-lane undivided roadway into a 4-lane divided highway and reconstruct the existing 3-lane roadway into a 4-lane roadway with a raised median	None
60-16	3.32	3.38	3.38	0.00%	None	None	<b>MP 223-225 (H7900):</b> Reconstruct existing 2-lane undivided roadway into a 4-lane divided highway and reconstruct the existing 3-lane roadway into a 4-lane roadway with a raised median	None
60-17	4.30	4.14	4.02	0.00%	None	None	<b>MP 221.72-223 (H7900):</b> Reconstruct existing 2-lane undivided roadway into a 4-lane divided highway and reconstruct the existing 3-lane roadway into a 4-lane roadway with a raised median	None

Level of Need* (Score)	Performance Score Need Scale		Segment Level Need Scale
None* (0)	> 3.57	< 10%	0
Low (1)	3.38 – 3.57	10% - 15%	< 1.5
Medium (2)	3.02 – 3.38	15% - 25%	1.5 – 2.5
High (3)	< 3.02	> 25%	> 2.5

*\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

### Bridge Needs Refinement and Contributing Factors

Bridge needs were identified on three segments of the corridor, 43 miles (20%) with a “Medium” level of bridge need and 28 miles (13%) with a “High” level of bridge need. These included all bridges that were documented having a bridge rating of 5 or less in deck, substructure, superstructure, or overall structural evaluation. One project is currently programmed related to bridge structural improvement on the US 60|US 70|US 191 corridor (Queen Creek Bridge (No. 406)).

Key contributing factors are summarized as follows:

- None of the initial needs required adjustment since no recent bridge work has occurred within the corridor that would change the bridge conditions.

- Nine bridges were defined as hot spots since they had multiple bridge ratings of 5 or less. Three bridges have bridge ratings of 4: Pinal Creek Bridge (No. 266), Waterfall Canyon Bridge (No. 328), and Queen Creek Bridge (No. 406).
- Of the nine hot spot bridges, five also showed repetitive investment issues. These included the Pinal Creek Bridge (No. 36), Pinal Creek Bridge (No. 266), Pinto Creek Bridge (No. 351), Waterfall Canyon Bridge (No. 328), and Queen Creek Bridge (No. 406).
- See other contributing factors in **Appendix D**.

**Table 13: Final Bridge Needs**

Segment #	Performance Score and Level of Need				Initial Segment Need*	Hot Spots	Recently Completed Projects	Final Segment Need*
	Bridge Index	Sufficiency Rating	Functionally Obsolete Bridges	Bridge Rating				
191-1	6.00	89.0	0.0%	6	None	None	None	None
191-2	5.37	76.9	0.0%	5	2.2	None	MP 37.97-45.80 (H8124): Bridge deck repairs MP 61.50-66.60 (H7883): Bridge railing replacement	Medium
191-3	6.02	93.9	0.0%	5	0.2	None	None	Low
191-4	6.00	69.5	0.0%	6	0.2	None	None	Low
191-5	No Bridges within Segment				None	None	None	None
70-6	6.00	69.1	0.0%	6	0.2	None	None	Low
70-7	5.77	71.6	0.0%	5	1.2	Holyoak Wash Bridge MP 302.53 (#514)	MP 326.25 (H8547): Matthewsville Wash Bridge #394 scour repair project MP 304.85 (H8547): Fine Wash Bridge #515 scour repair project MP 302.53 (H8547): Holyoak Wash Bridge #514 scour repair project	Low
70-8	6.00	74.0	0.0%	6	None	None	MP 299.51 (H8547): Bridge #513 scour repair project	None
70-9	No Bridges within Segment				None	None	None	None
70-10	7.00	80.0	0.0%	7	None	None	None	None
70-11	7.54	82.0	0.0%	5	0.2	None	None	Low
70-12	6.00	63.2	0.0%	6	0.2	None	MP 259 (H8359): Constructing concrete floors underneath the Gilson Wash Bridge (#464)	Low
70 60-13	5.17	78.9	49.4%	4	2.7	Pinal Creek Bridge MP 250.37 (#549), Pinal Creek Bridge MP 249.80 (#36), Pinal Creek Bridge MP 249.64 (#266), Bloody Tanks Bridge MP 243.71 (#173)	None	High

Table 13: Final Bridge Needs (continued)

Segment #	Performance Score and Level of Need				Initial Segment Need*	Hot Spots	Recently Completed Projects	Final Segment Need*
	Bridge Index	Sufficiency Rating	Functionally Obsolete Bridges	Bridge Rating				
60-14	4.56	36.0	0.0%	4	3.0	Pinto Creek Bridge MP 238.25 (#351), Waterfall Canyon Bridge MP 229.50 (#328), Queen Creek Bridge MP 227.71 (#406) Queen Creek Tunnel MP 228.47 (#407)	<b>MP 229.48-241.93(H5818):</b> Bridge repair (scour protection and column repair for Waterfall Canyon Bridge #328)	High
60-15	6.00	83.7	57.5%	6	0.3	None	<b>MP 225.00-226.87 (H7900):</b> New 4-lane rural divided and new 4-lane urban divided; Structure rehabilitation/ replacement	Low
60-16	5.00	86.7	0.0%	5	2.2	None	<b>MP 223-225 (H7900):</b> New 4-lane rural divided and new 4-lane urban divided; Structure rehabilitation/ replacement	None
60-17	6.42	91.1	0.0%	5	0.2	None	<b>MP 221.72-223 (H7900):</b> Structure rehabilitation/ replacement <b>MP 222.25 (H8566):</b> Bridge replacement project Queen Creek Bridge #296	Low

Level of Need* (Score)	Performance Score Need Scale				Segment Level Need Scale
None (0)	> 6.0	> 70	< 21.0%	> 5	0
Low (1)	5.5 – 6.0	60 – 70	21.0% - 31.0%	5	< 1.5
Medium (2)	4.5 – 5.5	40 – 60	31.0% - 49.0%	4	1.5 – 2.5
High (3)	< 4.5	< 40	> 49.0%	< 4	> 2.5

*\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

### Mobility Needs Refinement and Contributing Factors

Mobility was identified as a focus area for the US 60| US 70| US 191 corridor. A Low level of mobility need was identified on 168 miles (79%) of the corridor and a medium level of mobility need was identified on 33 miles (15%) of the corridor.

Key contributing factors are summarized below:

- Closures of the roadway due to flooding (US 191 at MP 53 and MP 66),
- A concentration of short term closures due to incidents/accidents throughout corridor,
- A significant number of extended duration closures on US 60 from MP 225 – 228,

- Mountainous grades with a lack of passing and climbing lanes on US 60 from MP 227 – 243,
- Limited passing, acceleration and deceleration on rolling terrain on US 70 from MP 255 – 330,
- Rockfall on US 60 caused repeated incidents of delay and closures between MP 228 – 248,
- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions,
- Limited bicycle accommodation on much of the corridor, on US 191 from MP 24 – 104 and MP 116 – 121, and US 60/70 from MP 298 – 243.

See other contributing factors in **Appendix D**.

**Table 14: Final Mobility Needs**

Segment #	Performance Score and Level of Need											Initial Segment Need*	Recently Completed Projects	Final Segment Need*
	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent		Directional TTI		Directional PTI		% Bicycle Accommodation			
			NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB				
191-1	0.15	0.17	0.12	0.12	0.03	0.01	1.51	1.30	4.79	7.47	66%	0.8	None	Low
191-2	0.09	0.10	0.07	0.07	0.02	0.00	1.16	1.16	9.83	6.09	100%	0.5	MP 37.97-45.80: Roadway excavation and borrow for widening of shoulders	Low
191-3	0.04	0.04	0.03	0.03	0.01	0.00	1.39	1.20	9.51	11.62	49%	1.5	None	Medium
191-4	0.18	0.20	0.14	0.14	0.03	0.03	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	96%	None	None	None
191-5	0.33	0.39	0.27	0.28	0.12	0.08	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	27%	0.6	None	Low
70-6	0.53	0.69	0.32	0.32	0.02	0.06	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	46%	0.6	None	Low
70-7	0.18	0.21	0.13	0.13	0.02	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	73%	0.2	None	Low
70-8	0.12	0.15	0.08	0.08	0.00	0.10	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0%	0.6	None	Low
70-9	0.25	0.29	0.16	0.17	0.00	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	26%	0.6	None	Low
70-10	0.17	0.19	0.11	0.11	0.09	0.04	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	4%	0.6	None	Low

Table 14: Final Mobility Needs (continued)

Segment	Performance Score and Level of Need											Initial Segment Need*	Recently Completed Projects	Final Segment Need*
	Mobility Index	Future Daily V/C	Existing Peak Hour V/C		Closure Extent		Directional TTI		Directional PTI		% Bicycle Accommodation			
			NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB				
70-11	0.21	0.26	0.12	0.12	0.10	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	4%	0.6	MP 270-271.27: Construct a 6 foot wide asphalt pathway, concrete sidewalk and pedestrian lighting	Low
70-12	0.19	0.23	0.13	0.13	0.04	0.31	Insufficient Data	1.10	Insufficient Data	1.40	23%	0.7	MP 255.30-270: Construct 6 foot wide asphalt pathway, concrete sidewalk and pedestrian lighting	Low
70 60-13	0.40	0.46	0.29	0.30	0.00	0.12	1.15	1.31	2.72	3.36	54%	0.4	None	Low
60-14	1.73	2.11	1.22	1.09	0.33	1.57	1.07	1.19	1.47	2.06	49%	5.6	MP 229.48-241.93 (H5818): Construct climbing / passing lanes	Medium
60-15	2.76	3.83	1.28	1.30	0.36	1.17	1.08	1.17	1.67	2.30	95%	5.2	MP 225-226.87 (H7900): Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None
60-16	0.54	0.71	0.28	0.28	0.50	0.00	1.09	1.00	1.91	1.04	87%	0.9	MP 223-225 (H7900): Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None
60-17	0.20	0.26	0.11	0.10	0.09	0.05	1.01	1.01	1.16	1.24	96%	None	MP 221.72-223 (H7900): Reconstructing the existing two-lane undivided roadway into a four-lane divided highway andreconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None

Level of Need* (Score)	Performance Score Need Scale					Segment Level Need Scale
None (0)	≤ 0.77 (Urban) ≤ 0.63 (Rural)	< 0.35	< 1.21	< 1.37	> 80%	0
Low (1)	0.77 - 0.83 (Urban) 0.63 - 0.69 (Rural)	0.35 – 0.49	1.21 – 1.27	1.37 – 1.43	70% - 80%	< 1.5
Medium (2)	0.83 - 0.95 (Urban) 0.69 - 0.83 (Rural)	0.49 – 0.75	1.27 – 1.39	1.43 – 1.57	50% - 70%	1.5 - 2.5
High (3)	≥ 0.95 (Urban) ≥ 0.83 (Rural)	> 0.75	> 1.39	> 1.57	< 50%	> 2.5

<sup>1</sup> Urban or Fringe Urban Operating Environment

<sup>2</sup> Rural Operating Environment

\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.

### Safety Needs Refinements and Contributing Factors

Safety was identified as a focus area for the US 60|US 70|US 191 corridor. A High level of safety need was identified for 67 miles (31%) of the corridor and Low level of safety need identified for 37 miles (17%) of the corridor.

Key contributing factors to the safety needs are summarized below:

- Fatalities on SB US 191 in the vicinity of MP 91 – 93, which were single vehicle roll over crashes involving high speed.
- On both US 191 and US 70 in the Safford area, factors included lack of pedestrian lighting and pedestrian facilities, traffic control device reflectivity, intersection geometry, and high traffic volumes

- US 70 from Bylas to Peridot, MP 293 – 274, long stretch of rolling terrain with limited passing lanes and rest areas, with safety factors including shoulder conditions and width, traffic control device reflectivity, clear zone slope and obstructions, and intersection geometry
- US 60/US 70 from Peridot to Superior, lack of passing and climbing lanes, deceleration lanes, pedestrian facilities, intersection geometry, high traffic volumes in urbanized areas with high volume of trucks and motorcycles from MP 227 - 243
- US 60/70 from Globe to Superior, MP 227 – 255, high crash rate due to shoulder conditions, shoulder width, high speeds, clear zone slope and obstructions, high traffic volumes
- US 60 WB from Superior to Florence Junction, MP 223 -212, with safety factors including reduced shoulder conditions and width and potential clear zone slope and obstructions
- See other Contributing Factors in **Appendix D**.

**Table 15: Final Safety Needs**

Segment #	Performance Score and Level of Need							Initial Segment Need*	Hot Spots	Recently Completed Projects	Final Segment Need*
	Safety Index	Directional Safety Index		Fatal + Incapacitating SHSP Top 5 %	SHSP Crash Unit Type %						
		NB/WB	EB/WB		Trucks	Motorcycle	Non-Motorized				
191-1	0.44	0.10	0.78	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	None	None	None	None
191-2	0.28	0.53	0.03	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	None	None	None	None
191-3	1.00	0.00	2.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	1.3	None	None	Low
191-4	0.03	0.07	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	None	None	None	None
191-5	1.30	1.34	1.25	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	2.5	None	None	High
70-6	0.93	1.68	0.18	73%	Insufficient Data	Insufficient Data	Insufficient Data	0.9	None	None	Low
70-7	0.10	0.20	0.00	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	None	None	None	None
70-8	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	None	None	N/A
70-9	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	None	None	N/A
70-10	1.88	1.50	2.25	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	3.6	None	None	High
70-11	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	None	None	N/A
70-12	1.67	1.67	1.67	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	3.6	None	None	High
70 60-13	2.09	1.64	2.55	56%	Insufficient Data	Insufficient Data	Insufficient Data	4.2	NB/WB: MP 246-249, SB/EB: MP 246-249	None	High
60-14	3.23	2.23	4.23	55%	Insufficient Data	Insufficient Data	Insufficient Data	4.0	NB/WB: MP 227-229, SB/EB: MP 232-234	MP 228.10-228.85 (H5818): Construct concrete barrier, installing guardrail and fence and related items	Medium

<sup>a</sup> 2 or 3 Lane Undivided

<sup>b</sup> 2,3 or 4 Lane Divided

<sup>c</sup> 4 or 5 Lane Undivided

\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.

Segment #	Performance Score and Level of Need							Initial Segment Need*	Hot Spots	Recently Completed Projects	Final Segment Need*
	Safety Index	Directional Safety Index		Fatal + Incapacitating SHSP Top 5 %	SHSP Crash Unit Type %						
		NB/WB	EB/WB		Trucks	Motorcycle	Non-Motorized				
60-15	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	None	MP 225-226.87 (H7900): Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	N/A
60-16	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	N/A	None	MP 223-225 (H7900): Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	N/A
60-17	0.81	1.28	0.33	42%	Insufficient Data	Insufficient Data	Insufficient Data	0.2	None	MP 221.72-223 (H7900): Reconstructing the existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None

Level of Need* (Score)		Performance Score Needs Scale					Segment Level Need Scale
None (0)	1	≤ 0.93	≤ 47%	≤ 4%	≤ 15%	≤ 7%	0
	2	≤ 0.94	≤ 42%	≤ 8%	≤ 9%	≤ 2%	
Low (1)	1	0.93 - 1.06	47% - 51%	4% - 5%	15% - 17%	7% - 9%	≤ 1.5
	2	0.94 - 1.06	42% - 50%	8% - 10%	9% - 11%	2.0% - 2.2%	
Medium (2)	1	1.06 - 1.33	51% - 59%	5% - 7%	17% - 22%	9% - 12%	1.5 - 2.5
	2	1.06 - 1.30	50% - 65%	10% - 13%	11% - 15%	2.2% - 2.8%	
High (3)	1	≥ 1.33	≥ 59%	≥ 7%	≥ 22%	≥ 12%	≥ 2.5
	2	≥ 1.30	≥ 65%	≥ 13%	≥ 15%	≥ 2.8%	

<sup>1</sup> Urban 4 Lane Freeway / Urban or Fringe Urban Operating Environment

<sup>2</sup> Rural 4 Lane Freeway < 25,000 vpd / Rural Operating Environment

*\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.*

### Freight Needs Refinements and Contributing Factors

Freight was identified as a focus area on the US 60|US 70|US 191 corridor. A Low level of freight needs was identified on 15 miles (7%) of the US 60| US 70| US 191 corridor and a High level of freight need was identified on 116 miles (54%) of the corridor. High level of delay related to the Planning Time Index (PTI) contributed to elevated freight needs for NB/SB US 191 MP 0 – 104, EB/WB US 60 MP 225 – 255, and EB US 70 MP 270 – 255.

Key contributing factors are summarized below:

- The number of closures on US 60| US 70| US 191 due to incidents/accidents or obstructions/ hazards are above statewide average in several areas
- Clearance restrictions exist at Pinal SPRR UP MP 253.63 (No. 562, height of 15.84 feet) and Queen Creek Tunnel MP 228.47 (height of 13.03 feet)
- See other Contributing Factors in **Appendix D**.

**Table 16: Final Freight Needs**

Segment #	Performance Score and Level of Need								Initial Segment Need*	Hot Spots	Recently Completed Projects	Final Segment Need*
	Freight Index	Directional TTTI		Directional TPTI		Closure Duration		Bridge Vertical Clearance				
		NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB					
191-1	0.10	1.94	1.60	9.11	11.62	6.78	0.61	No UP	3.9	None	None	High
191-2	0.09	1.00	1.54	2.68	19.67	2.41	0.70	22.04	3.4	None	Paving project completed, Cochise TI currently in design.	High
191-3	0.08	1.34	1.82	8.92	17.43	2.94	0.00	No UP	4.1	None	None	High
191-4	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	3.37	4.02	No UP	N/A	None	None	N/A
191-5	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	26.32	40.04	No Bridges	N/A	None	None	N/A
70-6	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	3.96	16.64	No UP	N/A	None	None	N/A
70-7	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	2.42	0.00	17.03	N/A	None	None	N/A
70-8	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.00	22.10	No UP	N/A	None	None	N/A
70-9	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	0.00	15.52	No Bridges	N/A	None	None	N/A
70-10	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	21.73	25.56	No UP	N/A	None	None	N/A
70-11	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data	27.45	0.00	No UP	N/A	None	None	N/A
70-12	Insufficient Data	Insufficient Data	1.14	Insufficient Data	2.01	7.71	127.15	No UP	0.5	None	None	Low
70 60-13	0.19	1.24	1.48	4.29	6.19	0.00	19.07	15.84	2.7	1 (Pinal SPRR UP - MP 253.63, #0562)	None	High
60-14	0.43	1.18	1.60	2.34	2.36	68.54	378.72	No Bridges	4.2	1 (Queen Creek Tunnel)	MP 229.48-241.93 (H5818): Construct climbing and passing lanes	Medium
60-15	0.33	1.13	1.25	1.87	4.23	107.46	249.09	16.79	4.2	None	MP 225-226.87 (H7900): Reconstructing existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	Low

Table 16: Final Freight Needs (continued)

Segment	Performance Score and Level of Need								Initial Segment Need*	Hot Spots	Recently Completed Projects	Final Segment Need*
	Freight Index	Directional TTTI		Directional TPTI		Closure Duration		Bridge Vertical Clearance				
		NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB					
60-16	0.49	1.14	1.00	2.98	1.12	108.80	0.00	No UP	3.5	None	MP 223-225 (H7900): Reconstructing existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	Low
60-17	0.72	1.07	1.14	1.23	1.54	13.65	19.62	No UP	None	None	MP 221.72-223 (H7900): Reconstructing existing two-lane undivided roadway into a four-lane divided highway and reconstructing the existing three-lane roadway into a four-lane roadway with a raised median	None

Level of Need* (Score)	Performance Score Need Scale					Segment Level Need Scale
None (0)	≥ 0.74	≤ 1.21	≤ 1.37	≤ 71.07	≥ 16.33	0
Low (1)	0.70 - 0.74	1.21 - 1.27	1.37 - 1.43	71.07 - 97.97	16.17 - 16.33	≤ 1.5
Medium (2)	0.64 - 0.70	1.27 - 1.39	1.43 - 1.57	97.97 - 151.75	15.83 - 16.17	1.5 - 2.5
High (3)	≤ 0.64	≥ 1.39	≥ 1.57	≥ 151.75	≤ 15.83	≥ 2.5

\*A segment need rating of ‘None’ does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as part of this study.

Segment Review

The needs for each segment were combined to numerically estimate the average level of need for each segment of the corridor. **Table 17** provides a summary of needs for each segment across all performance areas, with the overall average need for each segment presented in the last row. All of the segments showed a Low level of average need.

Table 17: Summary of Needs by Segment

Performance Area	Segment Number and Mileposts (MP)																
	191-1	191-2	191-3	191-4	191-5	70-6	70-7	70-8	70-9	70-10	70-11	70-12	70 60-13	60-14	60-15	60-16	60-17
	MP 0-24	MP 24-67	MP 87-104	MP 104-116	MP 116-121	MP 339-330	MP 330-300	MP 300-298	MP 298-293	MP 293-274	MP 274-270	MP 270-255	MP 255-243	MP 243-227	MP 227-225	MP 225-223	MP 223-212
Pavement	None*	Low	Low	Medium	Medium	Low	Low	None*	None*	Low	None*	None*	Low	None	None*	None*	None*
Bridge	None*	Medium	Low	Low	None*	Low	Low	None*	None*	None*	Low	Low	High	High	Low	None*	Low
Mobility+	Low	Low	Medium	None*	Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium	None*	None*	None*
Safety+	None*	None*	Low	None*	High	Low	None*	N/A#	N/A#	High	N/A#	High	High	Medium	N/A#	N/A#	None*
Freight+	High	High	High	N/A#	N/A#	N/A#	N/A#	N/A#	N/A#	N/A#	N/A#	Low	High	Medium	Low	Low	None*
Average Need	0.92	1.38	1.69	0.60	2.00	1.00	0.70	0.43	0.60	1.40	0.83	1.31	2.23	1.85	0.50	0.30	0.15

\*A segment need rating of 'None' does not indicate a lack of needed improvements; rather, it indicates that the segment performance score exceeds the established performance thresholds and strategic solutions for that segment will not be developed as this study.

+ Identified as an emphasis area for the US 60|US 70|US 191 corridor

# N/A indicates insufficient or no data available to determine level of need

Average Need Scale	
None*	< 0
Low	0.1-1.0
Medium	1.0-2.0
High	> 2.0

### Summary of Corridor

The needs in each performance area are shown in **Figure 21** and summarized below:

#### Pavement Needs

- Of the 214 corridor miles, approximately 119 miles (55%) exhibit a “Low” level of pavement need and 17 miles (17%) exhibit “Medium” level of pavement need.
- Pavement hot spot failure needs were identified for 17 miles on US 191, 3 miles on US 70, and 3 miles on US 60.
- A high level of historical investment has occurred on Segments 70-9 and 70-10 through the San Carlos Indian Reservation and a medium level of historical investment has occurred through the remaining corridor segments, excluding Segment 191-1.

#### Bridge Needs

- Bridge needs were identified on three segments of the corridor, 43 miles (20%) with a “Medium” level of bridge need and 28 miles (13%) with a “High” level of bridge need.
- Eight bridges showed potential repetitive investment issues and may be candidates for life-cycle cost analysis to evaluate alternative solutions.
- Three bridges have bridge ratings of 4: Pinal Creek Bridge (No. 266), Waterfall Canyon Bridge (No. 328), and Queen Creek Bridge (No. 406).
- One bridge had a bridge rating of 5: Pinal Creek Bridge (No. 36).
- Nine bridges were defined as hot spots since they had multiple bridge ratings of 5 or less.
- Of the nine hot spot bridges, five also showed repetitive investment issues. These included the Pinal Creek Bridge (No. 36), Pinal Creek Bridge (No. 266), Pinto Creek Bridge (No. 351), Waterfall Canyon Bridge (No. 328), and Queen Creek Bridge (No. 406).

#### Mobility Needs

- Mobility Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A low level of mobility need was identified on 168 miles (79%) of the US 60| US 70| US 191 corridor and a medium level of mobility need was identified on 33 miles (15%) of the corridor.
- Contributing factors include to reduced mobility performance includes:
  - Closures of the roadway due to flooding (US 191 at MP 53 and MP 66),
  - A concentration of short term closures due to incidents/accidents throughout corridor,
  - A significant number of extended duration closures on US 60 from MP 225 – 228,
  - Mountainous grades with a lack of passing and climbing lanes on US 60 from MP 227 – 243,
  - Limited passing, acceleration and deceleration on rolling terrain on US 70 from MP 255 – 330,
  - Rockfall on US 60 caused repeated incidents of delay and closures between MP 228 – 248,

- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions,
- Limited bicycle accommodation on much of the corridor, on US 191 from MP 24 – 104 and MP 116 – 121, and US 60/70 from MP 298 – 243.

#### Safety Needs

- Safety Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A High level of safety need was identified for 67 miles (31%) of the corridor and Low level of safety need identified for 37 miles (17%) of the corridor.
- Contributing factors to the safety need include:
  - Fatalities on SB US 191 in the vicinity of MP 91 – 93, which were single vehicle roll over crashes involving high speed.
  - On both US 191 and US 70 in the Safford area, factors included lack of pedestrian lighting and pedestrian facilities, traffic control device reflectivity, intersection geometry, and high traffic volumes
  - US 70 from Bylas to Peridot, MP 293 – 274, long stretch of rolling terrain with limited passing lanes and rest areas, with safety factors including shoulder conditions and width, traffic control device reflectivity, clear zone slope and obstructions, and intersection geometry
  - US 60/US 70 from Peridot to Superior, lack of passing and climbing lanes, deceleration lanes, pedestrian facilities, intersection geometry, high traffic volumes in urbanized areas with high volume of trucks and motorcycles from MP 227 - 243
  - US 60/70 from Globe to Superior, MP 227 – 255, high crash rate due to shoulder conditions, shoulder width, high speeds, clear zone slope and obstructions, high traffic volumes
  - US 60 WB from Superior to Florence Junction, MP 223 -212, with safety factors including reduced shoulder conditions and width and potential clear zone slope and obstructions.

#### Freight Needs

- Freight Performance is an Emphasis Area for the US 60| US 70| US 191 corridor, giving it a heavier weight in the analysis.
- A Low level of freight needs was identified on 15 miles (7%) of the US 60|US 70|US 191 corridor and a High level of freight need was identified on 116 miles (54%) of the corridor.
- High level of delay related to the Planning Time Index (PTI) contributed to elevated freight needs for NB/SB US 191 MP 0 – 104, EB/WB US 60 MP 225 – 255, and EB US 70 MP 270 – 255.
- The number of closures on US 60| US 70| US 191 due to incidents/accidents or obstructions/ hazards are above statewide average in the following areas:
  - US 191 MP 0 – 67 including flooding at MP 53 and MP 66

- US 191 MP 43 (Border Patrol Check Point)
- Concentration of short term closures due to incidents/accidents at the following locations:
  - Incidents/accidents US 191 MP 115 – 120
  - US 60 from MP 233 – 242,
  - US 60 from MP 228 – 231.7 (with a high concentration of incidents at MP 230), and
  - US 60 from MP 224 – 227
- Significant number of extended duration closures on US 60 from MP 225 – 228
- Mountainous grades with a lack of passing and climbing lanes on US 60 from MP 227 - 243
- Limited passing, acceleration and deceleration on rolling terrain on US 70 MP 255 - 330
- Rockfall on US 60 caused repeated incidents of delay and closures between MP 228 – 248
- Weather related delay and closures on US 60 between MP 224-243 due to snow, ice and impassable conditions
- Clearance restrictions exist at Pinal SPRR UP MP 253.63 (No. 562, height of 15.84') and Queen Creek Tunnel MP 228.47 (height of 13.03').

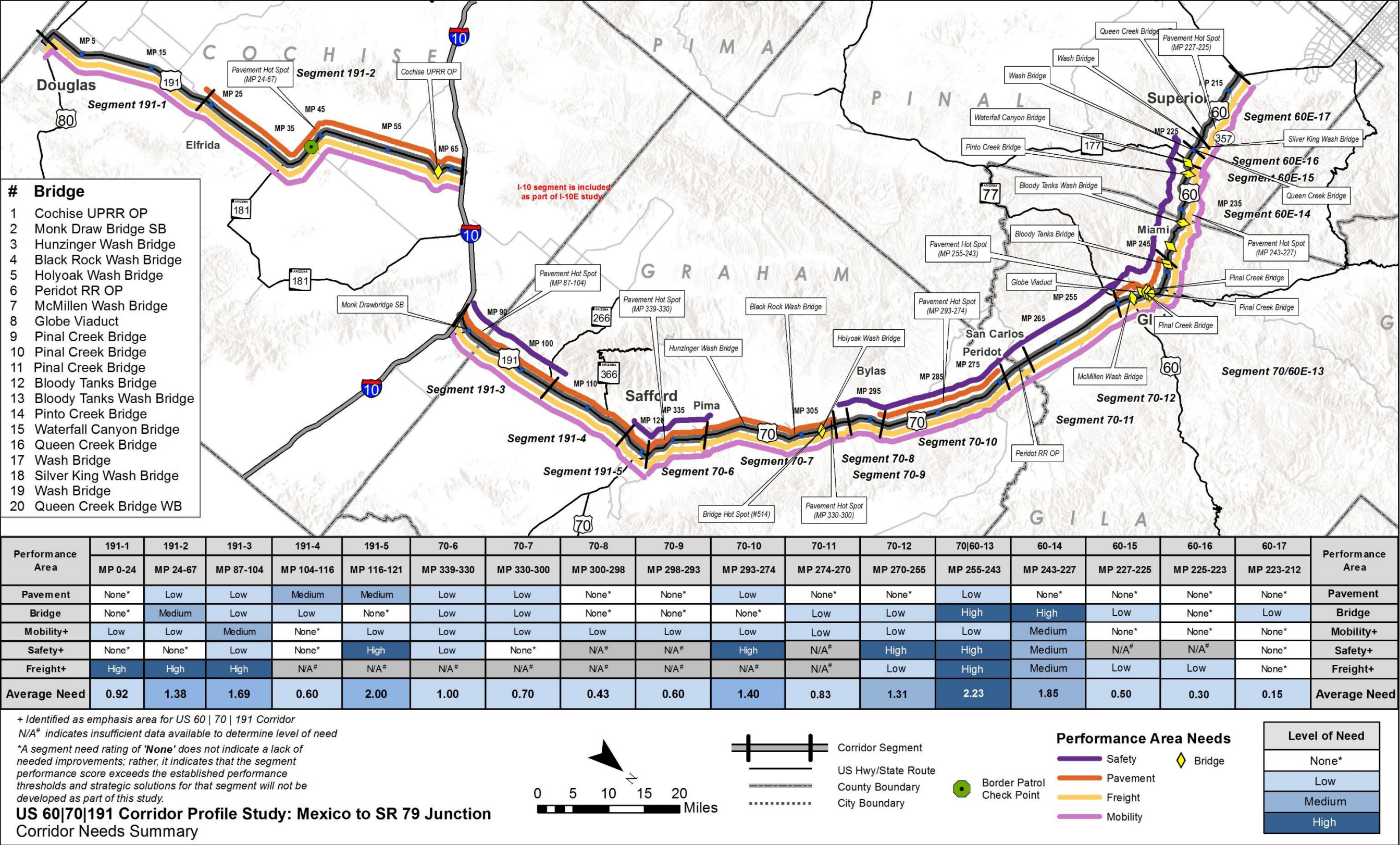
- Segment 70|60-13 has an overall High need and the highest need score in the corridor. Some needs are site specific while others are characteristics of the segment. High bridge needs are related to the Pinal Creek Bridge (No. 36) and Pinal Creek Bridge (No. 266), which are hot spots due to poor structural ratings and exhibit high repetitive investment. High safety needs are due to the more urbanized area with increased volumes and speeds too fast for conditions. High freight needs are due to TTI and PTI times, as well as the Pinal SPRR at MP 253.63 have low vertical clearance (15.84').
- Segment 60-14 also registers an overall High need score on the corridor. This segment has significant grades and subsequently suffers from freight and mobility needs related to delay and incidents/accidents associated with the grade. The segment includes 3 hot spot bridges, all of which have repetitive investment histories. The Queen Creek Tunnel, also located in the segment, affects bridge and freight needs with poor deck ratings and low vertical clearance.

### Overlapping Needs

This section identifies overlapping performance needs on the US 60|US 70|US 191 corridor, which provides guidance to develop strategic solutions that address more than one performance area with elevated levels of need. Completing projects that address multiple needs presents the opportunity to more effectively improve overall performance. A summary of the overlapping needs that relate to locations with elevated levels of need is provided below:

- Most segments on the corridor have overlapping needs, approximately 205 miles of the 214 miles or 96% of the corridor. The exceptions include Segments 70-8, 70-9 and 60-16. Traffic counters do not exist in Segments 191-4 through 70-11, approximately 75 miles or 35% of the corridor, resulting in insufficient data to calculate needs in the freight performance area for those locations.
- US 191 MP 87 to MP 104 (Segment 191-3) and US 60|70 MP 243 to MP 255 (Segment 70|60-13) have overlapping needs in all five performance areas. These segments comprised 29 of the 214 corridor miles.
- Segment 191-3 has an overall Medium need, with some level of need in all performance areas. The greater needs relate to mobility and freight due to high TTI and PTI related to accidents and incidents. A few closures have long durations that impacted the segment need level. Also noteworthy is that this segment is immediately north of I-10 and utilized when traffic is detoured through Safford during I-10 closures.

Figure 21: Corridor Needs Summary



## 4.0 STRATEGIC SOLUTIONS

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State’s key transportation corridors. One of the first steps in the development of strategic solutions is to identify areas of elevated levels of need (i.e., Medium or High). Addressing areas of Medium or High need will have the greatest effect on corridor performance and are the focus of the strategic solutions. Segments with Medium or High needs and specific locations of hot spots are considered strategic investment areas for which strategic solutions should be developed. Segments with lower levels of need or without identified hot spots are not considered candidates for strategic investment and are expected to be addressed through other ADOT programming processes. The US 60|US 70|US 191 strategic investment areas (resulting from the elevated needs) are shown in **Figure 22**.

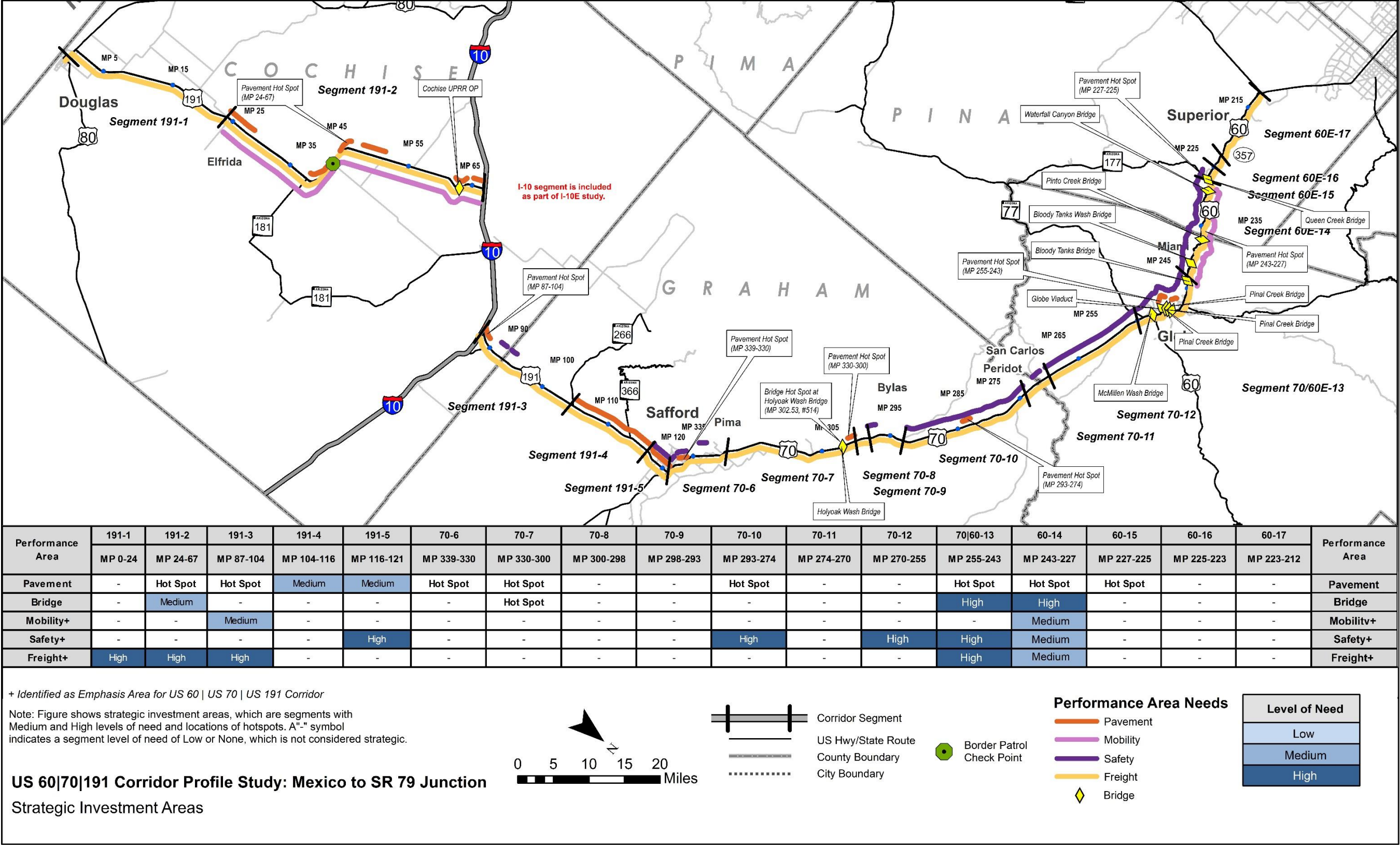
### 4.1 Screening Process

This section examines qualifying strategic needs and determines if the needs in those locations require action. In some cases, needs that are identified do not advance to solutions development and are screened out from further consideration because they have been or will be addressed through other measures including:

- A project is programmed to address this need
- The need is a result of a Pavement or Bridge hot spot that does not show historical investment or rating issues; these hot spots will likely be addressed through other ADOT programming means.
- A bridge is not a hot spot but is located within a segment with a Medium or High level of need; this bridge will likely be addressed through current ADOT bridge maintenance and preservation programming processes.
- The need is determined to be non-actionable (i.e., cannot be addressed through an ADOT project)
- The conditions/characteristics of the location have changed since the performance data was collected that was used to identify the need

**Table 18** notes if each potential strategic need advanced to solution development, and if not, the reason for screening the potential strategic need out of the process. Locations advancing to solutions development are marked with Yes (Y); locations not advancing are marked with No (N) and highlighted. This screening table provides specific information about the needs in each segment that will be considered for strategic investment. The table identifies the level of need – either Medium or High segment needs, or segments without Medium or High level of need that have a hot spot. Each area of need is assigned a location number in the screening table to help document and track locations considered for strategic investment.

Figure 22: Strategic Investment Areas



**Table 18: Strategic Investment Area Screening**

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
191-1 (MP 0 – 24)	-	-	-	-	High	L1	Freight	Congestion/delay related to trucks due to high PTI in both directions. Friction with large trucks, oversized vehicles and Douglas Port of Entry.	N	No programmed project to address freight need because freight need was due to weigh station.
191-2 (MP 24-67)	Hot Spot	Medium	-	-	High	L2	Pavement	Hot Spot in NB lanes MP 48-51 (Excessive Cracking)	N	A medium level of historical investment has occurred on Segment 191-2 according to PeCOS data and recent pavement preservation projects. No pavement preservation projects are currently programmed for this portion of the segment. Anticipated to be addressed through current ADOT pavement maintenance and preservation programming processes.
						L3	Bridge	Medium level of need related to deck rating =5. The bridge was not identified as a Hot Spot.  Cochise UPRR OP (MP 62.88, #157)	N	Structure does not have a historical rating issue according to the historical review, therefore it is not considered for strategic investment. Issues related to this bridge such as narrow width, use by oversized vehicles, and other safety concerns have been observed. These items will potentially be addressed in the solutions identified for need location L4.
						L4	Freight	Congestion/delay related to trucks due to high PTI in the southbound direction.	Y	
191-3 (MP 87-104)	Hot Spot	-	Medium	-	High	L5	Pavement	Hot Spot in SB lanes MP 87-88 (Excessive Cracking)	N	A medium level of historical investment has occurred on Segment 191-3. One future pavement preservation project was identified between MP 86.89 - 90.11, ADOT Five Year Program (H7866-FY18). Anticipated to be addressed through current ADOT pavement maintenance and preservation programming processes.
						L6	Mobility	NB direction, high delay due to a few very long duration closures.	N	No programmed project to address mobility need. This segment was improved to a four-lane divided facility in 2009, its ultimate cross section. Current and future traffic volumes can be accommodated by the four-lane roadway. High closure durations are likely due to the location of the traffic counter providing data (within an intersection).
						L7	Freight	Congestion/delay related to trucks, with high TTI and PTI in both directions, primarily due to a few very long duration closures.	N	No programmed project to address freight need. This segment was improved to a four-lane divided facility in 2009, its ultimate cross section. Current and future traffic volumes can be accommodated by the four-lane roadway. High closure durations are likely due to the location of the traffic counter providing data (within an intersection).
191-4 (MP 104-116)	Medium	-	-	-	-	L8	Pavement	Hot Spot in NB lanes MP 105-107 (High IRI)	N	A medium level of historical investment has occurred on Segment 191-4. No pavement preservation projects are currently programmed for this portion of the segment. Anticipated to be addressed through current ADOT pavement maintenance and preservation programming processes.

Legend:  Strategic investment area screened out from further consideration.

**Table 18: Strategic Investment Area Screening (continued)**

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
191-5 (MP 116-121)	Medium	-	-	High	-	L9	Pavement	Hot Spot in NB lanes MP 120-121 (High IRI)	N	The segment had an initial need of medium and one hot spot was identified. One programmed projects exists in this segment, MP 116-118, ADOT Five Year Program FY16 (H8700). Anticipated to be addressed through current ADOT pavement maintenance and preservation programming processes.
						L10	Safety	Lack of pedestrian lighting and pedestrian facilities, traffic control device reflectivity, intersection geometry, and high traffic volumes. 40% involved pedestrians, 20% involved pedestrians not using the crosswalk, 40% involved left turns, 40% involved failure to yield right-of-way, 40% occurred in dark unlighted condition, and 40% occurred in dark lighted conditions, and 60% involved drugs or alcohol.  The higher concentration of incidents can be associated with the urbanized area of Safford in addition to the limited controlled intersection. Project H8324 is programmed and will support and increase of safety and mobility through the US 191/US 70 intersection.	Y	
70-6 (MP 339-330)	Hot Spot	-	-	-	-	L11	Pavement	Hot Spot in WB lanes MP 336-337 (High IRI)	N	A low level of historical investment has occurred on Segment 70-6. No pavement preservation projects are currently programmed for this portion of the segment. Anticipated to be addressed through current ADOT pavement maintenance and preservation programming processes.
70-7 (MP 330-300)	Hot Spot	Hot Spot	-	-	-	L12	Pavement	Hot Spot in WB lanes MP 300-301 (Excessive Cracking)	N	A low level of historical investment has occurred on Segment 70-6. A pavement preservation chipseal is programmed.
						L13	Bridge	Hot Spot at Holyoak Wash Bridge (MP 302.53, #514)	N	Structures do not have a historical rating issue according to the review, therefore they are not considered for strategic investment. Anticipated to be addressed through current ADOT bridge maintenance and preservation programming processes.
70-8 (MP 300 - 298)	-	-	-	-	-	No Strategic Needs Identified				

Legend:  Strategic investment area screened out from further consideration.

Table 18: Strategic Investment Area Screening (continued)

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
7-9 (MP 298 – 293)	-	-	-	-	-	No Strategic Needs Identified				
70-10 (MP 293-274)	Hot Spot	-	-	High	-	L14	Pavement	Hot Spot in WB lanes MP 283-284 (Hot Spot failure, High IRI). District is currently seeking funding for pavement preservation.	Y	
						L15	Safety	The high level of initial and final need is associated with the high ratio of fatal crashes compared to those resulting in incapacitating injuries. This segment has rolling hills and valleys with few safe passing opportunities. 40% involved collision with motor vehicle, 40% involved overturning, 60% were single vehicle crashes, 20% was head on, 20% drove in the opposing lane, 20% driver inattention/distraction, 40% dark unlighted conditions.	Y	
70 – 11 (MP 274 – 270)	-	-	-	-	-	No Strategic Needs Identified				
70-12 (MP270-255)	-	-	-	High	-	L16	Safety	The high level of initial and final need is associated with the high ratio of fatal crashes compared to those resulting in incapacitating injuries. 50% involved a pedestrian, 50% were head on collisions, 25% drove in opposing lane, 25% involved unsafe passing, 50% involved crossing centerline, 25% involved drugs/alcohol.	Y	

Legend:  Strategic investment area screened out from further consideration.

**Table 18: Strategic Investment Area Screening (continued)**

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
70 60-13 (MP255-243)	Hot Spot	High	-	High	High	L17	Pavement	Hot Spot in EB lanes MP 247-248 (Hot Spot Failure) and Hot Spot in EB lanes MP 249-251 (Hot Spot Failure and Excessive Cracking)	N	A medium level of historical investment has occurred on Segment 191-2. No pavement preservation projects are currently programmed for this portion of the segment. Anticipated to be addressed through current ADOT pavement maintenance and preservation programming processes.
						L18	Bridge	Pinal Creek Bridge MP 250.37 (#549)	N	No historical rating issues.
						L19	Bridge	Pinal Creek Bridge MP 249.80 (#36)	Y	
						L20	Bridge	Pinal Creek Bridge MP 249.64 (#266)	Y	
						L21	Bridge	Bloody Tanks Bridge MP 243.71 (#173)	N	No historical rating issues.
						L22	Safety	Hot Spots at EB/WB MP 246-249; The higher concentration of incidents can be associated with the urbanized areas of Globe and Miami. 11% collisions with fixed object, 9% with pedestrian, 29% involved rear end collision, 26% involved failure to yield right of way, 20% driver inattention/distraction, 17% speed too fast for conditions, 23% in dark lighted conditions, 6% in dusk conditions, 9% ran off the road to the right.	Y	
						L23	Freight	High EB PTI (delay), can be contributed to signals located on steep grades in the EB direction with significant delay if trucks stop at signal.	Y	
						L24	Freight	Bridge clearance at Pinal SPRR UP (MP 253.63, #0562) (15.84')	Y	

Legend:  Strategic investment area screened out from further consideration.

**Table 18: Strategic Investment Area Screening (continued)**

Segment # and MP	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
60-14 (MP243-227)	Hot Spot	High	Medium	Medium	Medium	L25	Pavement	Hot Spot in WB lanes MP 229-233 (High IRI) and WB MP 235-236 (High IRI)	N	A medium level of historical investment has occurred on Segment 191-2. No pavement preservation projects are currently programmed for this portion of the segment. Anticipated to be addressed through current ADOT pavement maintenance and preservation programming processes.
						L26	Bridge	Pinto Creek Bridge MP 238.25 (#351)	N	Programmed FY18
						L27	Bridge	Queen Creek Bridge MP 227.71 (#406). Project Assessment is currently underway for scoping improvements.	Y	
						L28	Bridge	Waterfall Canyon Bridge MP 229.50 (#328)	Y	
						L29	Bridge	Queen Creek Tunnel MP 228.47 (#407)	N	Non-actionable per discussion with District
						L30	Mobility	PTI/delay, mountainous terrain, high number of closures/duration	Y	
						L31	Safety	Hot Spots at WB: MP 227-229 and EB: MP 232-234; The high initial and final need can be associated with the mountainous terrain along this section of the corridor. 38% collision with fixed object, 14% head on, 38% speed too fast for conditions, 24% dark unlighted conditions, 3% dark lighted, 14% wet/slush conditions, 45% ran off road to the right, 28% crossed centerline, 24% under the influence of drugs/alcohol	Y	
						L32	Freight	High EB TTI, High EB/WB PTI, and High Closure Duration EB due to mountainous grades	Y	

Legend:  Strategic investment area screened out from further consideration.

Table 18: Strategic Investment Area Screening (continued)

Segment	Level of Strategic Need					Location #	Type	Need Description	Advance (Y/N)	Screening Description
	Pavement	Bridge	Mobility	Safety	Freight					
60-15 (MP227-225)	Hot Spot	-	-	-	-	L33	Pavement	WB MP 226-227	N	A medium level of historical investment has occurred on Segment 191-2. This pavement will be replaced under the Silver King to Superior Streets (H7900) project.
60-16 (MP225-223)	-	-	-	-	-	No Strategic Needs Identified				
60-17 (MP223-212)	-	-	-	-	-	No Strategic Needs Identified				

Legend:  Strategic investment area screened out from further consideration.

## 4.2 Candidate Solutions

For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution:

- Preservation
- Modernization
- Expansion

Documented performance needs serve as the foundation for developing candidate solutions for corridor preservation, modernization, and expansion. Candidate solutions are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT’s traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the US 60|US 70|US 191 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

### Characteristics of Strategic Solutions

Candidate solutions should include some or all of the following characteristics:

- Do not recreate or replace results from normal programming processes
- May include programs or initiatives, areas for further study, and infrastructure projects
- Address elevated levels of need (High or Medium) and hot spots
- Focus on investments in modernization projects (to optimize current infrastructure)
- Address overlapping needs
- Reduce costly repetitive maintenance
- Extend operational life of system and delay expansion
- Leverage programmed projects that can be expanded to address other strategic elements
- Provide measurable benefit

### Candidate Solutions

A set of 14 candidate solutions are proposed to address the identified needs on the US 60|US 70|US 191 corridor.

**Table 19** identifies each strategic location that has been assigned a candidate solution with a number (e.g., CS8.1, CS8.2, etc.). Each candidate solution is comprised of one or more components to address the identified needs. The assigned candidate solution numbers are linked to the location number and provide tracking capability through the rest of the process. The locations of proposed solutions are shown on the map in **Figure 23**.

Candidate solutions developed to address an elevated need in the Pavement or Bridge performance area will include two options; rehabilitation or full replacement. These solutions are initially evaluated through a Life-Cycle Cost Analysis (LCCA) to provide insights into the cost-effectiveness of these options so a recommended approach can be identified. Candidate solutions developed to address an elevated need in the Mobility, Safety, or Freight performance areas are advanced directly to the Performance Effectiveness Evaluation. In some cases, there may be multiple solutions identified to address the same area of need.

Candidate solutions that are recommended to expand or modify the scope of an already programmed project are noted and are not advanced to solution evaluation and prioritization. These solutions are directly recommended for programming.

**Table 19: Candidate Solutions**

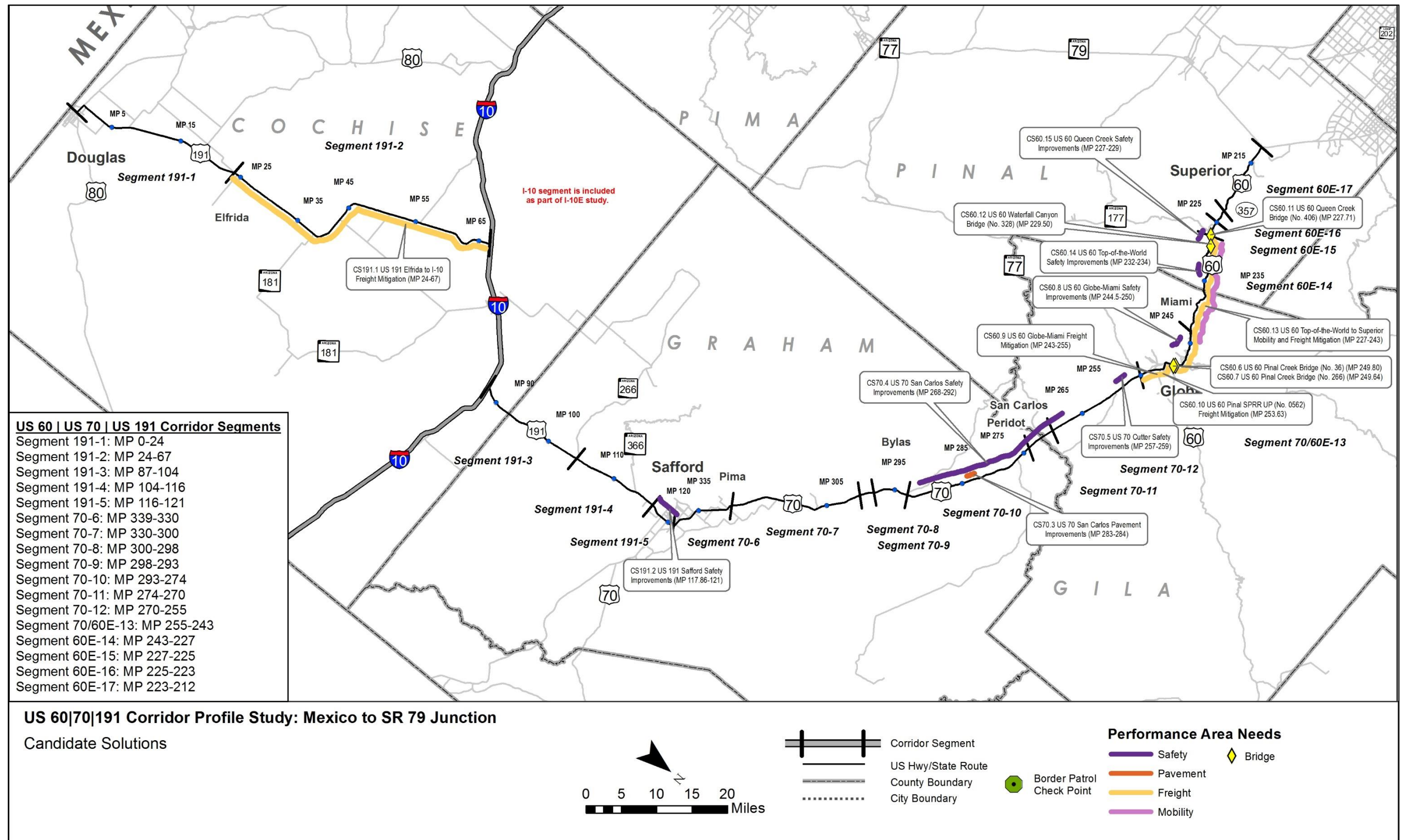
Candidate Solution #	Segment #	Location #	Beginning MP	Ending MP	Candidate Solution Name	Option*	Scope	Investment Category Preservation (P) Modernization (M) Expansion (E)
CS191.1	191-2	L4	59.9	64	US 191 Elfrida to I-10 Freight Mitigation	A B	Realign roadway from MP 59.9 to MP 64.2, replace Cochise RR bridge  Realign roadway from MP 59.9 to MP 64.2, construct passing lane, replace Cochise RR bridge	M
CS191.2	191-5	L10	117	121	US 191 Safford Safety Improvements	-	Intersection improvements: <ul style="list-style-type: none"> <li>Armory Road Intersection (MP 118): Improve signal visibility, install warning signs with beacons in advance of intersection</li> <li>Discovery Park Intersection (MP 119): Improve signal visibility, dynamic speed warning signs</li> <li>Lone Star Intersection (MP 119.5): Install signal with crosswalk and lighting, install warning signs with beacons in advance of intersection</li> <li>16<sup>th</sup> Street (MP 120.5): Install warning signs with beacons in advance of intersection</li> </ul>	M
CS70.3	70-10	L14	283	284	US 70 San Carlos Pavement Improvement	A B	Replace Pavement Rehabilitate Pavement	P P
CS70.4	70-10	L15	268	292	US 70 San Carlos Safety Improvements	-	Install high-visibility signage Install warning signs with beacons at curves and speed feedback signs (MP 292, MP 280, MP 278.5) Install warning signs and speed feedback signs entering high pedestrian area (WB MP 273, EB MP 269) Install centerline rumble strip Widen shoulder, install rumble strip and install safety edge Construct passing lanes (EB MP 262 - 264 and WB MP 282 - 288) Formalize pullouts (signage, ROW for pullouts) (WB MP 274.5, EB MP 279, EB MP 289, WB 292)	M
CS70.5	70-12	L16	258	260	US 70 Cutter Safety Improvements	-	Install warning signage in advance of intersection (EB MP 259 and WB MP 260) Construct center lane (MP 258.4 – 259.5) Install lighting (MP 258.2 – 259.5)	M
CS60.6	70 60-13	L19	249.80	249.80	US 60 Pinal Creek Bridge (No. 36)	A B	Replace bridge Rehabilitate bridge	M M
CS60.7	70 60-13	L20	249.64	249.64	US 60 Pinal Creek Bridge (No. 266)	A B	Replace bridge Rehabilitate bridge	M M

**Table 19: Candidate Solutions (continued)**

Candidate Solution #	Segment #	Location #	Beginning MP	Ending MP	Candidate Solution Name	Option*	Scope	Investment Category Preservation (P) Modernization (M) Expansion (E)
CS60.8	70 60-13	L22	244.5	250	US 60 Globe-Miami Safety Improvements	-	Install lighting (MP 244.5 to 250) Install speed feedback signs (2 EB and 2 WB between MP 246 - 250) Install warning signs with beacons in advance of SR 188 intersection	M
CS60.9	70 60-13	L24	253.63	253.63	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	-	Reprofile mainline	M
CS60.10	60-14	L27	227.71	227.71	US 60 Queen Creek Bridge (No. 406)	A B	Replace bridge Rehabilitate bridge	M
CS60.11	60-14	L28	229.50	229.50	US 60 Waterfall Canyon Bridge (No. 328)	A B	Replace bridge Rehabilitate bridge	M
CS60.12	60-14	L30/L32	227	243	US 60 Superior to Miami Mobility and Freight Mitigation	A  B  C	Widen shoulder (EB MP 227.0 to 227.6, EB MP 227.7 to 228.3, EB MP 228.5 to 232, WB 238.0 to 239.5), install rock-fall mitigation (WB MP 227.7 to 228, WB MP 233 to 233.3, WB MP 240.2 to 240.4, WB MP 239.5 to 239.45, WB MP 239.6 to 239.75), install dynamic weather warning beacons, and install RWIS  EB climbing/passing lane (MP 227-227.9, MP 230.4 – 232.6), WB climbing/passing lane (MP 236.4 – 236.6, MP 238.1 – 239.5), Five-lane widening (MP 234.2 – 236.4), install rock-fall mitigation (WB MP 227.7 to 228, WB MP 233 to 233.3, WB MP 240.2 to 240.4, WB MP 239.5 to 239.45, WB MP 239.6 to 239.75), and dynamic weather warning beacons, and install RWIS  Construct four-lane divided (using 2 existing-lanes for one direction)	M  E  E
CS60.13	60-14	L31	232	234	US 60 Top-of-the-World Safety Improvements	-	Install warning signage and speed feedback signs Improve sign visibility Install centerline rumble strip	M
CS60.14	60-14	L31	227	229	US 60 Queen Creek Safety Improvements	-	Widen shoulder, install rumble strip and install safety edge Install guardrail Install warning signage and speed feedback signs Improve sign visibility Install centerline rumble strip <i>Note: Queen Creek Tunnel limits omitted from solution (MP 228.3 – 228.5)</i>	M

\* '-' indicates only one solution is being proposed and no option

### Figure 23: Candidate Solutions



### 5.0 SOLUTION EVALUATION AND PRIORITIZATION

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation are shown in **Figure 24** and described more fully below.

Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

When multiple independent candidate solutions are developed for Mobility, Safety, or Freight strategic investment areas, these candidate solution options advance directly to the Performance Effectiveness Evaluation without an LCCA.

Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

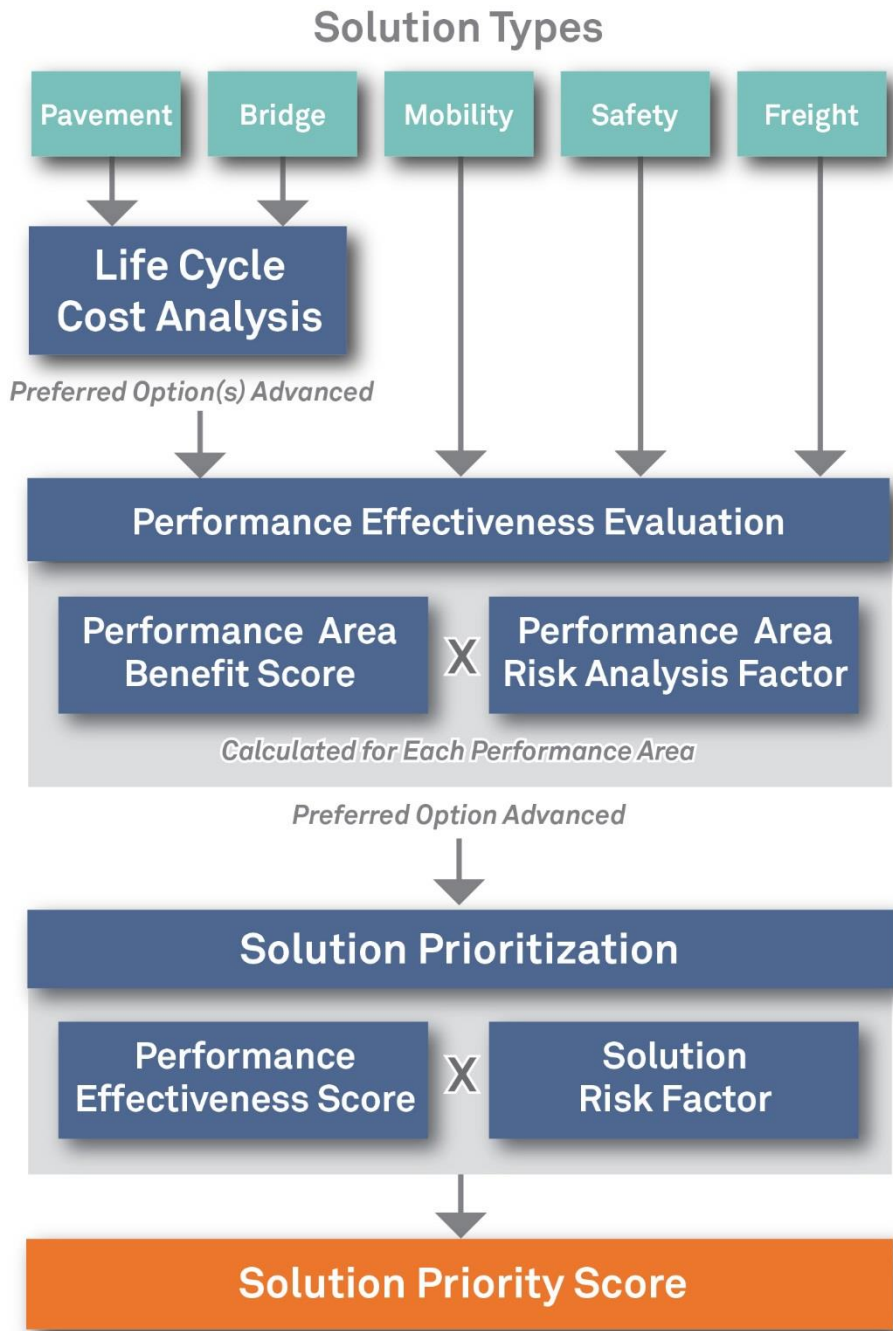
Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure.

Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure 24: Candidate Solution Evaluation Process



## 5.1 Life-Cycle Cost Analysis

LCCA is conducted for any candidate solution that is developed as a result of a need in the Pavement or Bridge Performance Area. The intent of the LCCA is to determine which options warrant further investigation and eliminate options that would not be considered strategic.

LCCA is an economic analysis that compares cost streams over time and presents the results in a common measure, the present value of all future costs. The cost stream occurs over an analysis period that is long enough to provide a reasonably fair comparison among alternatives that may differ significantly in scale of improvement actions over shorter time periods. For both bridge and pavement LCCA, the costs are focused on agency (ADOT) costs for corrective actions to meet the objective of keeping the bridge or pavement serviceable over a long period of time.

LCCA is performed to provide a more complete holistic perspective on asset performance and agency costs over the life of an investment stream. This approach helps ADOT look beyond initial and short-term costs, which often dominate the considerations in transportation investment decision making and programming.

### Bridge LCCA

For the bridge LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected bridges, as described below:

- Bridge replacement (large upfront cost but small ongoing costs afterwards)
- Bridge rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- On-going repairs until replacement (low upfront and ongoing costs until replacement)

The bridge LCCA model developed for the CPS reviews the characteristics of the candidate bridges including bridge ratings and deterioration rates to develop the three improvement strategies (full replacement, rehabilitation until replacement, and repair until replacement). Each strategy consists of a set of corrective actions that contribute to keeping the bridge serviceable over the analysis period. Cost and effect of these improvement actions on the bridge condition are essential parts of the model. Other considerations in the model include bridge age, elevation, pier height, length to span ratio, skew angle, and substandard characteristics such as shoulders and vehicle clearance. The following assumptions are included in the bridge LCCA model:

- The bridge LCCA only addresses the structural condition of the bridge and does not address other issues or costs
- The bridge will require replacement at the end of its 75-year service life regardless of current condition
- The bridge elevation, pier height, skew angle, and length to span ratio can affect the replacement and rehabilitation costs
- The current and historical ratings are used to estimate a rate of deterioration for each candidate bridge

- Following bridge replacement, repairs will be needed every 20 years
- Different bridge repair and rehabilitation strategies have different costs, expected service life, and benefit to the bridge rating
- The Net Present Value (NPV) of future costs are discounted at 3% and all dollar amounts are in 2015 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution is not be considered strategic and the rehabilitation or repair will be addressed by normal programming processes
- Since this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA NPV results that are within 15% should be considered equally; in such a case, the solution should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed

Based on the candidate solutions presented in **Table 19**, LCCA was not conducted for any bridges on the US 60|US 70|US 191 corridor. A summary of this analysis is shown in **Table 20**. Additional information regarding the LCCA is included in **Appendix E**.

### Pavement LCCA

The LCCA approach to pavement is very similar to the process used for bridges. For the pavement LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected pavement, as described below:

- Pavement replacement (large upfront cost but small ongoing costs afterwards – could be replacement with asphalt or concrete pavement)
- Pavement major rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- Pavement minor rehabilitation until replacement (low upfront and ongoing costs until replacement)

The pavement LCCA model developed for the CPS reviews the characteristics of the candidate paving locations including the historical rehabilitation frequency to develop potential improvement strategies (full replacement, major rehabilitation until replacement, and minor rehabilitation until replacement, for either concrete or asphalt, as applicable). Each strategy consists of a set of corrective actions that contribute to keeping the pavement serviceable over the analysis period. The following assumptions are included in the pavement LCCA model:

- The pavement LCCA only addresses the condition of the pavement and does not address other issues or costs
- The historical pavement rehabilitation frequencies at each location are used to estimate future rehabilitation frequencies
- Different pavement replacement and rehabilitation strategies have different costs and expected service life

- The NPV of future costs are discounted at 3% and all dollar amounts are in 2015 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution will not be considered strategic and the rehabilitation will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA NPV results that are within 15% should be considered equally; in such a case, the solution should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed

As shown in Tables 20 and 21, the following conclusions were determined based on the LCCA:

- Replacement is the only viable option for the following bridges due since their service life has expired (75-years) or will expire prior to the next possible programming year.
  - US 60 Pinal Creek Bridge (No. 36) – Built in 1920
  - US 60 Pinal Creek Bridge (No. 266) – Built in 1942
  - US 60 Queen Creek Bridge (No. 406) – Built in 1949
  - US 60 Waterfall Canyon Bridge (No. 328) – Built in 1929
- Pavement rehabilitation was the most cost effective option for improving the pavement quality between MP 283 and MP 284 on US 70.

Based on the candidate solutions presented in **Table 19**, LCCA was conducted for one pavement project on the US 60|US 70|US 191 corridor. A summary of this analysis is shown in **Table 21**. Additional information regarding the LCCA is contained in **Appendix E**.

As shown in **Table 20** and **Table 21**, the following conclusions were determined based on the LCCA

**Table 20: Bridge Life Cycle Cost Analysis Results**

Candidate Solution	Present Value at 3% Discount Rate (\$)			Ratio of Present Value Compared to Lowest Present Value			Other Needs	Results
	Replace	Rehab	Repair	Replace	Rehab	Repair		
US 60 Pinal Creek Bridge (No. 36)	\$2,501,301	-	-	1.00	-	-	-	Considered a strategic solution to replace the bridge
US 60 Pinal Creek Bridge (No. 266)	\$3,297,230	-	-	1.00	-	-	-	Considered a strategic solution to replace the bridge
US 60 Queen Creek Bridge (No. 406)	\$9,322,474	-	-	1.00	-	-	-	Considered a strategic solution to replace the bridge
US 60 Waterfall Canyon Bridge (No. 328)	\$1,600,870	-	-	1.00	-	-	-	Considered a strategic solution to replace the bridge

**Table 21: Pavement Life Cycle Cost Analysis Results**

Candidate Solution	Present Value at 3% Discount Rate (\$)				Ratio of Present Value Compared to Lowest Present Value				Other Needs	Results
	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation		
US 60 San Carlos Pavement Improvement (CS70.3, MP 283 to 284)	\$4,761,541	\$4,988,867	<b>\$3,996,045</b>	\$4,607,111	1.19	1.25	1.00	1.15	No	Reconstruction is not within 15% of lowest cost - Rehabilitation is recommended

## 5.2 Performance Effectiveness Evaluation

The results of the Performance Effectiveness Evaluation are combined with the results of a Performance Area Risk Analysis to determine the PES. The objectives of the Performance Effectiveness Evaluation include:

- Measure the benefit to the performance system versus the cost of the solution
- Include risk factors to help differentiate between similar solutions
- Apply to each performance area that is affected by the candidate solution
- Account for emphasis areas identified for the corridor

The Performance Effectiveness Evaluation includes the following steps:

- Estimate the post-solution performance for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight)
- Use the post-solution performance scores to calculate a post-solution level of need for each of the five performance areas
- Compare the pre-solution level of need to the post-solution level of need to determine the reduction in level of need (potential solution benefit) for each of the five performance areas
- Calculate performance area risk weighting factors for each of the five performance areas
- Use the reduction in level of need (benefit) and risk weighting factors to calculate the PES

### Post-Solution Performance Estimation

For each performance area, a slightly different approach is used to estimate the post-solution performance. This process is based on the following assumptions:

- Pavement:
  - The IRI rating would decrease (to 30 for replacement or 45 for rehabilitation)
  - The Cracking rating would decrease (to 0 for replacement or rehabilitation)
- Bridge:
  - The structural ratings would increase (+1 for repair, +2 for rehabilitation, or increase to 8 for replacement)
  - The Sufficiency Rating would increase (+10 for repair, +20 for rehabilitation, or increase to 98 for replacement)
- Mobility:
  - Additional lanes would increase the capacity and therefore affect the Mobility Index and associated secondary measures
  - Other improvements (ramp metering, parallel ramps, variable speed limits) would also increase the capacity (to a lesser extent than additional lanes) and therefore would affect the Mobility Index and associated secondary measures
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTI secondary measure

- Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the PTI secondary measure
- Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Extent secondary measure
- Safety:
  - Crash modification factors were developed that would be applied to estimate the reduction in crashes (for additional information see **Appendix F**)
- Freight:
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Freight Index and the TPTI secondary measure
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the TTTI secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Duration secondary measure

### Performance Area Risk Analysis

The Performance Area Risk Analysis is intended to develop a numeric risk weighting factor for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight). This risk analysis addresses other considerations for each performance area that are not directly included in the performance system. A risk weighting factor is calculated for each candidate solution based on the specific characteristics at the solution location. For example, the Pavement Risk Factor is based on factors such as the elevation, daily traffic volumes, and amount of truck traffic. Additional information regarding the Performance Area Risk Factors is included in **Appendix G**.

Following the calculation of the reduction in level of need (benefit) and the Performance Area Risk Factors, these values are used to calculate the PES. In addition, the reduction in level of Need in each emphasis area is also included in the PES.

### Net Present Value Factor

The benefit (reduction in need) is measured as a one-time benefit. However, different types of solutions will have varying service lives during which the benefits will be obtained. For example, a preservation solution would likely have a shorter stream of benefits over time when compared to a modernization or expansion solution. To address the varying lengths of benefit streams, each solution is classified as a 10-year, 20-year, 30-year, or 75-year benefit stream, or the NPV factor ( $F_{NPV}$ ). A 3% discount rate is used to calculate  $F_{NPV}$  for each classification of solution. The service lives and respective factors are described below:

- A 10-year service life is generally reflective of a preservation solution; this would include pavement and bridge preservation solutions which would likely have a 10-year stream of benefits; for these solutions, a  $F_{NPV}$  of 8.8 is used in the PES calculation

- A 20-year service life is reflective of modernization solutions that generally do not include new infrastructure; these solutions would likely have a 20-year stream of benefits; for these solutions, a  $F_{NPV}$  of 15.3 is used in the PES calculation
- A 30-year service life is generally reflective of an expansion solution or a modernization solution that includes new infrastructure; these solutions would likely have a 30-year stream of benefits; for these solutions, a  $F_{NPV}$  of 20.2 is used in the PES calculation
- A 75-year service life is used for bridge replacement solutions; for these solutions, a  $F_{NPV}$  of 30.6 is used in the PES calculation

#### Vehicle-Miles Travelled Factor

Another factor in assessing benefits is the number of travelers who would benefit from the implementation of the candidate solution. This factor varies between candidate solutions depending on the length of the solution and the magnitude of daily traffic volumes. Multiplying the solution length by the daily traffic volume results in vehicle-miles travelled (VMT), which provides a measure of the amount of traffic exposure that would receive the benefit of the proposed solution. The VMT is converted to a VMT factor (known as  $F_{VMT}$ ), which is on a scale between 0 and 5, using the equation below:

$$F_{VMT} = 5 - (5 \times e^{VMT \times -0.0000139})$$

#### Performance Effectiveness Score

The PES is calculated using the following equation:

$$PES = (\text{Sum of all Risk Factored Benefit Scores} + \text{Sum of all Risk Factored Emphasis Area Scores}) / \text{Cost} \times F_{VMT} \times F_{NPV}$$

Where:

*Risk Factored Benefit Score = Reduction in Segment-Level Need (benefit) x Performance Area Risk Weighting Factor (calculated for each performance area)*

*Risk Factored Emphasis Area Score = Reduction in Corridor-Level Need x Performance Area Risk Factors x Emphasis Area Factor (calculated for each emphasis area)*

*Cost = estimate cost of candidate solution in millions of dollars (see **Appendix H**)*

*$F_{VMT}$  = Factor between 0 and 5 to account for VMT at location of candidate solution based on existing (2014) daily volume and length of solution*

*$F_{NPV}$  = Factor (ranging from 8.8 to 30.6 as previously described) to address anticipated longevity of service life (and duration of benefits) for each candidate solution*

The resulting PES values are shown in **Table 22**. Additional information regarding the calculation of the PES is contained in **Appendix I**.

For candidate solutions with multiple options to address Mobility, Safety, or Freight needs, the PES should be compared to help identify the best performing option. If one option clearly performs better than the other options (e.g., more than twice the PES value and a difference in magnitude of at least 20 points), the other options should be eliminated from further consideration. If multiple options have similar PES values, those options should all be advanced to the prioritization process. On the US 60|US 70|US 191 corridor, the following candidate solutions have options:

- CS191.1 (A, B) – US 191 Elfrida to I-10 Freight Mitigation
- CS60.12 (A, B, C) - US 60 Superior to Miami Mobility and Freight Mitigation MP 227-243

**Table 22: Performance Effectiveness Scores**

Candidate Solution #	Segment #	Option	Candidate Solution Name	Milepost Location	Estimated Cost* (\$ million)	Risk Factored Benefit Score					Risk Factored Emphasis Area Scores			Total Factored Benefit Score	F <sub>VMT</sub>	F <sub>NPV</sub>	Performance Effectiveness Score
						Pavement	Bridge	Safety	Mobility	Freight	Safety	Mobility	Freight				
191.1	191-2	A	US 191 Elfrida to I-10 Freight Mitigation Realign Roadway	MP 59.9-64	\$46.7	0.82	6.02	0.00	0.81	0.87	0.00	0.23	0.03	8.79	0.40	20.2	1.5
		B	US 191 Elfrida to I-10 Freight Mitigation Realign Roadway and Construct Passing Lanes	MP 59.9-64	\$62.7	0.82	6.02	0.00	1.05	0.87	0.00	0.31	0.03	9.11	0.40	20.2	1.2
191.2	191-5	-	US191 Safford Safety Improvements	MP 117-121	\$0.6	0.00	0.00	2.97	0.00	0.00	0.01	0.00	0.00	2.98	1.03	8.8	42.4
70.4	70-10	-	US 70 San Carlos Safety Improvements	MP 268-292	\$57.7	0.00	0.00	17.83	9.41	0.00	0.24	0.08	0.00	27.55	3.42	15.3	25.0
70.5	70-12	-	US 70 Cutter Safety Improvements	MP 257-260	\$3.0	0.00	0.00	4.03	0.29	0.00	0.05	0.18	0.00	4.55	0.55	8.8	7.4
60.6	70 60-13	-	US 60 Pinal Creek Bridge (#36)	MP 249.8	\$2.4	0.00	3.03	0.00	0.40	0.00	0.00	0.11	0.00	3.54	0.71	30.6	32.7
60.7	70 60-13	-	US 60 Pinal Creek Bridge (#226)	MP 249.64	\$3.1	0.00	3.54	0.00	0.40	0.00	0.00	0.11	0.00	4.04	0.71	30.6	28.4
60.8	70 60-13	-	US 60 Globe-Miami Safety Improvements	MP 244.5-251	\$7.7	0.00	0.00	12.81	0.00	0.00	0.13	0.00	0.02	12.96	2.84	8.8	42.1
60.9	70 60-13	-	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	MP 253.4-253.8	\$0.6	0.00	0.00	0.00	0.00	3.51	0.00	0.00	0.02	3.53	0.19	20.2	22.1
60.10	60-14	-	US 60 Queen Creek Bridge (#406)	MP 227.71	\$8.8	0.00	6.18	0.04	1.21	0.00	0.00	0.24	0.00	7.66	0.73	30.6	19.5
60.11	60-14	-	US 60 Waterfall Canyon Bridge (#328)	MP 229.5	\$1.7	0.00	3.77	0.00	0.82	0.00	0.00	0.16	0.00	4.74	0.59	30.6	51.7
60.12	60-14	A	US 60 Superior to Miami Widen Shoulders	MP 227-243	\$8.4	0.00	0.00	5.71	4.78	0.82	0.08	0.25	0.06	11.70	1.57	15.3	33.6
		B	US 60 Superior to Miami Climbing/ Passing Lanes	MP 227-243	\$66.5	0.00	6.83	7.45	1.83	0.80	0.10	0.29	0.04	17.33	4.33	20.2	22.8
		C	US 60 Superior to Miami Construct New 4-Lane Divided	MP 227-243	\$497.8	0.85	6.10	10.92	130.72	6.41	0.22	1.70	0.13	157.04	4.33	20.2	27.6
60.13	60-14	-	US 60 Top-of-the-World Safety Improvements	MP 232-234	\$0.2	0.00	0.00	1.99	0.01	0.00	0.05	0.00	0.02	2.06	0.31	8.8	27.2
60.14	60-14	-	US 60 Queen Creek Safety Improvements	MP 227-229	\$3.2	0.00	0.00	5.43	7.22	0.80	0.07	0.24	0.02	13.79	0.91	8.8	34.5

### 5.3 Solution Risk Analysis

Following the calculation of the PES, an additional step is taken to develop the prioritized list of solutions. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure. **Figure 25** shows the risk matrix used to develop the risk weighting factors.

**Figure 25: Risk Matrix**

		Severity/Consequence				
		Insignificant	Minor	Significant	Major	Catastrophic
Frequency/ Likelihood	Very Rare	Low	Low	Low	Moderate	Major
	Rare	Low	Low	Moderate	Major	Major
	Seldom	Low	Moderate	Moderate	Major	Severe
	Common	Moderate	Moderate	Major	Severe	Severe
	Frequent	Moderate	Major	Severe	Severe	Severe

Using the risk matrix in **Figure 25**, numeric values were assigned to each category of frequency and severity. The higher the risk, the higher the numeric factor that was assigned. The risk weight for each area of the matrix was calculated by multiplying the severity factor times the frequency factor. These numeric factors are shown in **Figure 26**.

**Figure 26: Numeric Risk Matrix**

			Severity/Consequence				
			Insignificant	Minor	Significant	Major	Catastrophic
		Weight	1.00	1.10	1.20	1.30	1.40
Frequency/ Likelihood	Very Rare	1.00	1.00	1.10	1.20	1.30	1.40
	Rare	1.10	1.10	1.21	1.32	1.43	1.54
	Seldom	1.20	1.20	1.32	1.44	1.56	1.68
	Common	1.30	1.30	1.43	1.56	1.69	1.82
	Frequent	1.40	1.40	1.54	1.68	1.82	1.96

Using the values in **Figure 26**, risk weighting factors were calculated for each of the four risk categories (low, moderate, major, and severe). These values are simply the average of the values in **Figure 26** that fall within each category. The resulting average risk weighting factors are:

Low	Moderate	Major	Severe
1.14	1.36	1.51	1.78

The risk weighting factors listed above are assigned to the five performance areas as follows:

- Safety = 1.78
  - The Safety performance area quantifies the likelihood of fatal or incapacitating injury crashes; therefore, it is assigned the Severe (1.78) risk weighting factor
- Bridge = 1.51
  - The Bridge performance area focuses on the structural adequacy of bridges; a bridge failure may result in crashes or traffic being detoured for long periods of time resulting in significant travel time increases; therefore, it is assigned the Major (1.51) risk weighting factor
- Mobility and Freight = 1.36
  - The Mobility and Freight performance areas focus on capacity and congestion; failure in either of these performance areas would result in increased travel times but would not have significant effect on safety (crashes) that would not already be addressed in the Safety performance area; therefore, they are assigned the Moderate (1.36) risk weighting factor
- Pavement = 1.14
  - The Pavement performance area focuses on the ride quality of the pavement; failure in this performance area would likely be a spot location that would not dramatically affect drivers beyond what is already captured in the Safety performance area; therefore, it is assigned the Low (1.14) risk weighting factor

The benefit in each performance area is calculated for each candidate solution as part of the Performance Effectiveness Evaluation. Using this information on benefits and the risk factors listed above, a weighted (based on benefit) solution-level numeric risk factor is calculated for each candidate solution. For example, a solution that has 50% of its benefit in Safety and 50% of its benefit in Mobility has a weighted risk factor of 1.57 ( $0.50 \times 1.36 + 0.50 \times 1.78 = 1.57$ ).

### 5.4 Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score as follows:

$$\text{Prioritization Score} = \text{PES} \times \text{Weighted Risk Factor} \times \text{Segment Average Need Score}$$

Where:

*PES = Performance Effectiveness Score as shown in **Table 22***

*Weighted Risk Factor = Weighted factor to address risk of not implementing a solution based on the likelihood and severity of the performance failure*

*Segment Average Need Score = Segment average need score as shown in **Table 17***

**Table 23** shows the prioritization scores for the candidate solutions subjected to the solution evaluation and prioritization process. Solutions that address multiple performance areas tend to score higher in this process. A prioritized list of candidate solutions is provided in the subsequent section. See **Appendix J** for additional information on the prioritization process.

**Table 23: Prioritization Scores**

Candidate Solution #	Segment	Option	Candidate Solution Name	Milepost Location	Estimated Cost* (\$ million)	Performance Effectiveness Score	Weighted Risk Factor	Segment Need	Prioritization Score	Percentage by which Solution Reduces Performance Area Segment Needs				
										Pavement	Bridge	Mobility	Safety	Freight
191.1	191-2	A	US 191 Elfrida to I-10 Freight Mitigation Realign Roadway	59.9-64	\$46.7	1.5	1.45	1.38	<b>3</b>	100%	100%	14%		3%
		B	US 191 Elfrida to I-10 Freight Mitigation Realign Roadway and Construct Passing Lanes	59.9-64	\$62.7	1.2	1.44	1.38	<b>2</b>	100%	100%	18%		3%
191.2	191-5	-	US191 Safford Safety Improvements	117-121	\$0.6	42.4	1.78	2.00	<b>151</b>				23%	
70.4	70-10	-	US 70 San Carlos Safety Improvements	268-292	\$57.7	25.0	1.64	1.39	<b>57</b>			38%	36%	
70.5	70-12	-	US 70 Cutter Safety Improvements	257-260	\$3.0	7.4	1.75	1.31	<b>17</b>			11%	59%	
60.6	70 60-13	-	US 60 Pinal Creek Bridge (#36)	249.8	\$2.4	32.7	1.49	2.23	<b>109</b>		30%	11%		
60.7	70 60-13	-	US 60 Pinal Creek Bridge (#226)	249.64	\$3.1	28.4	1.50	2.23	<b>95</b>		35%	11%		
60.8	70 60-13	-	US 60 Globe-Miami Safety Improvements	244.5-251	\$7.7	42.1	1.79	2.23	<b>167</b>			4%	30%	2%
60.9	70 60-13	-	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	253.4-253.8	\$0.6	22.1	1.36	2.23	<b>67</b>					26%
60.10	60-14	-	US 60 Queen Creek Bridge (#406)	227.71	\$8.8	19.5	1.49	2.00	<b>58</b>		49%	1%		
60.11	60-14	-	US 60 Waterfall Canyon Bridge (#328)	229.5	\$1.7	51.7	1.48	2.00	<b>153</b>		30%	1%		
60.12	60-14	A	US 60 Superior to Miami Widen Shoulders	227-243	\$8.4	33.6	1.57	2.00	<b>106</b>			1%	14%	5%
		B	US 60 Superior to Miami Climbing/ Passing Lanes	227-243	\$66.5	22.8	1.61	2.00	<b>73</b>		55%	7%	17%	11%
		C	US 60 Superior to Miami Construct New 4-Lane Divided	227-243	\$497.8	27.6	1.40	2.00	<b>77</b>	57%	49%	92%	25%	13%
60.13	60-14	-	US 60 Top-of-the-World Safety Improvements	232-234	\$0.2	27.2	1.78	2.00	<b>97</b>				5%	
60.14	60-14	-	US 60 Queen Creek Safety Improvements	227-229	\$3.2	34.5	1.53	2.00	<b>106</b>			6%	12%	2%

## 6.0 SUMMARY OF CORRIDOR RECOMMENDATIONS

### 6.1 Prioritized Candidate Solution Recommendations

**Table 24** and **Figure 27** show the prioritized candidate solutions recommended for the US 60|US 70|US 191 corridor. Implementation of these solutions is anticipated to improve performance of the corridor. The following observations were noted about the prioritized solutions:

- Most of the anticipated improvements in performance are in the Mobility, Safety, and Freight performance areas
- The highest ranking solutions tended to have overlapping benefits in the Mobility, Safety, and Freight performance areas
- The highest priority solutions address needs in the US 60 Superior to Miami area (MP 227 to MP 243)

### 6.2 Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor-specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the US 60|US 70|US 191 corridor:

- A Sign Visibility Study in the Safford area along US 191 is recommended to identify locations with potential to improve retroreflectivity. Poor visibility of crossroads in the Safford area is causing a higher level of crashes.
- Road Safety Assessments are recommended in Peridot, Cutter and Globe to identify safety improvements, specifically pedestrian circulation and access needs in Peridot.
- Access Control Studies in Peridot (MP 270 – 274) and Globe-Miami (MP 243 – 255) are recommended to identify potential for access consolidation, signage, etc to reduce friction and improve safety.
- Recommend Superior to Globe DCR/Feasibility Study
- Recommend San Carlos Area (MP 268 – 292) Superelevation Study

### 6.3 Policy and Initiative Recommendations

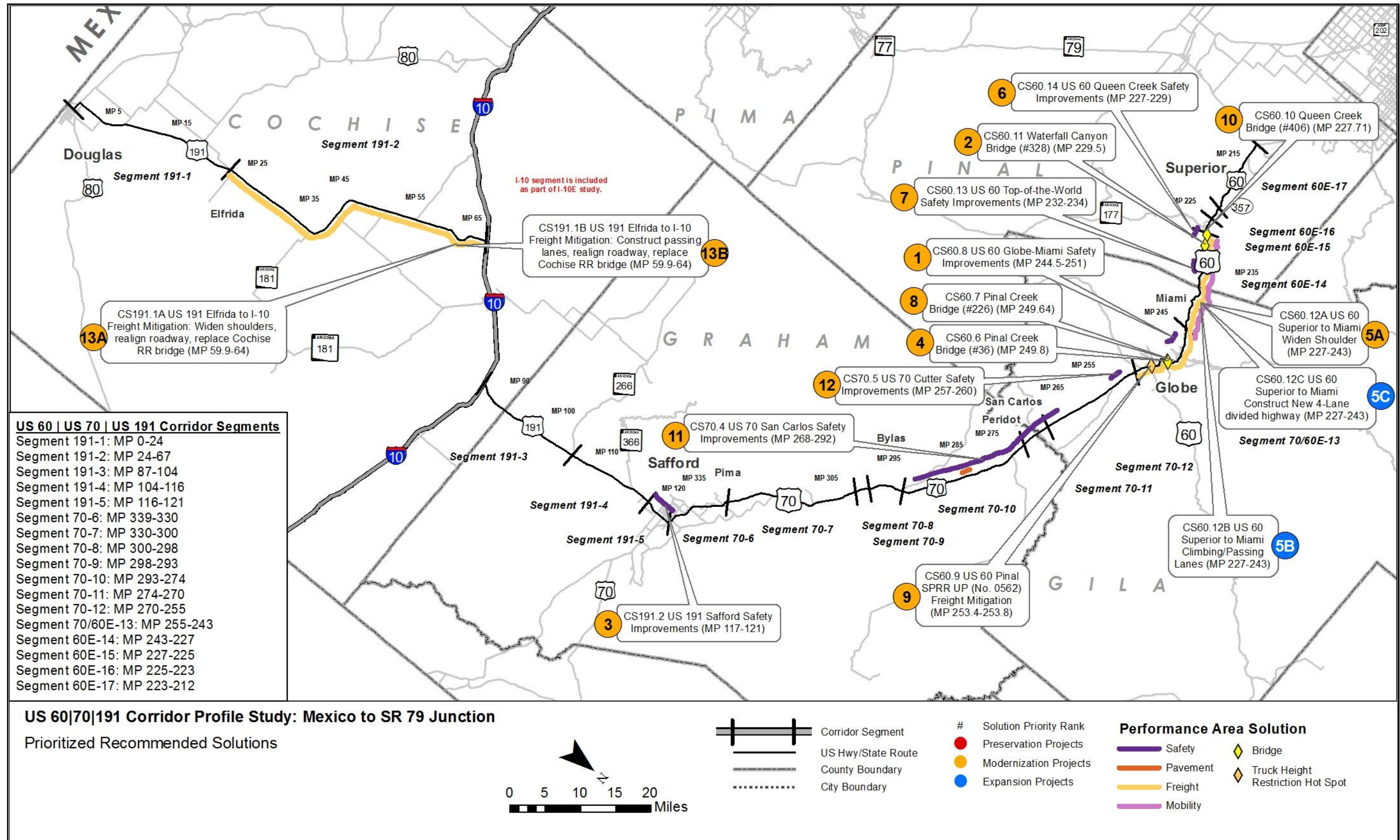
In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through this process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on US 60|US 70|US 191, but across the entire state highway system where the conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic message signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects. In pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is required to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

**Table 24: Prioritized Recommended Solutions**

Rank	Candidate Solution #	Option	Solution Name and Location	Description / Scope	Estimated Cost (in millions)	Investment Category Preservation [P] Modernization [M] Expansion [E]	Prioritization Score
1	60.8	-	US 60 Globe-Miami Safety Improvements	Install lighting Install speed feedback signs (MP 246 - 250) Install warning signs with beacons in advance of SR 188 intersection	\$7.7	M	167
2	60.11	-	US 60 Waterfall Canyon Bridge (#328)	Replace Bridge	\$1.7	M	153
3	191.2	-	US191 Safford Safety Improvements	US 191/Armory Road Intersection: Install Warning Signs with Beacons, Improve Signal Visibility US 191/Discovery Park Intersection: Improve Signal Visibility, Install Dynamic Speed Feedback Signs US 191/Lone Star Intersection: Install Traffic Signal, Install Warning Signs with Beacons US 191/16th Street Intersection: Install Warning Signs with Beacons	\$0.6	M	151
4	60.6	-	US 60 Pinal Creek Bridge (#36)	Replace Bridge	\$2.4	M	109
5	60.12	A	US 60 Top-of-the-World to Superior Widen shoulder	Widen Shoulders (EB MP 227.0 to 227.6, EB MP 227.7 to 228.3, EB MP 228.5 to 232, WB 238.0 to 239.5), Install Rock-Fall Mitigation (WB MP 227.7 to 228, WB MP 233 to 233.3, WB MP 240.2 to 240.4, WB MP 239.5 to 239.45, WB MP 239.6 to 239.75), dynamic weather warning beacons and RWIS. *Note: Queen Creek Tunnel limits omitted from solution (MP 228.3 – 228.5)	\$8.4	M	106
		C	US 60 Top-of-the-World to Superior Construct New 4-lane divided	Construct four-lane divided (using 2 existing-lanes for one direction) (Cost based upon US 60 Superior to Globe Feasibility Study 2014)	\$497.8	E	77
		B	US 60 Top-of-the-World to Superior Climbing/ Passing Lanes	Widen Shoulders (EB MP 227.0 to 227.6, EB MP 227.7 to 228.3, EB MP 228.5 to 232, WB 238.0 to 239.5), Install Rock-Fall Mitigation (WB MP 227.7 to 228, WB MP 233 to 233.3, WB MP 240.2 to 240.4, WB MP 239.5 to 239.45, WB MP 239.6 to 239.75); Install Dynamic Weather Warning Beacons and RWIS	\$66.5	E	73
6	60.14	-	US 60 Queen Creek Safety Improvements	Widen Shoulders; Install Warning Signs, Dynamic Speed Feedback Signs, Centerline Rumble Strip, Guardrail (EB and WB)	\$3.2	M	106
7	60.13	-	US 60 Top-of-the-World Safety Improvements	Install Warning Signs, Dynamic Speed Feedback Signs, High Visibility Edge Line Striping, Centerline Rumble Strip	\$0.2	M	97
8	60.7	-	US 60 Pinal Creek Bridge (#226)	Replace Bridge	\$3.1	M	95
9	60.9	-	US 60 Pinal SPRR UP (No. 0562) Freight Mitigation	Re-profile roadway to achieve 16.5 feet vertical clearance	\$0.6	M	67
10	60.10	-	US 60 Queen Creek Bridge (#406)	Replace Bridge	\$8.8	M	58
11	70.4	-	US 70 San Carlos Safety Improvements	Install Centerline Rumble Strip (MP 268-292), Warning Signs with Beacons (MP 278.5, 280, 292), Warning Signs (MP 269, 273), Dynamic Speed Feedback Signs (MP 268, 273, 278.5, 280, 292); Widen Shoulders (MP 270-292); Formalize Pullouts (WB MP 274.5, EB MP 279, EB MP 289, WB 292); Construct Passing Lane (WB MP 282-288 and EB 262-264)	\$57.7	M	57
12	70.5	-	US 70 Cutter Safety Improvements	Install Lighting and Center Turn Lane	\$3.1	M	16
13	191.1A	A	US 191 Elfrida to I-10 Freight Mitigation: Widen shoulders, realign roadway, replace Cochise RR bridge	Realign Roadway, Replace Cochise RR Bridge	\$46.7	M	3
		B	US 191 Elfrida to I-10 Freight Mitigation: Construct passing lanes, realign roadway, replace Cochise RR bridge	Realign Roadway, Construct Passing Lanes (NB and SB), Replace Cochise RR Bridge	\$62.7	M	2

Figure 27: Prioritized Recommended Solutions



## 6.4 Next Steps

The candidate solutions recommended in this study are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the US 60|US 70|US 191 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendations from such studies are still relevant to addressing the ultimate corridor objectives.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.